Vo XVII, No. 3 OCTOBER, 1946

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

America Produces for Prosperity . . . . . *by A. M. Sargent*

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Principles of Job Measurement . . . . . *by W. C. E. Prins and Del T. McWilliams*

Report on Plastic Tooling . . . . . *by Thomas A. Dickinson*

Crush Form Thread Grinding—British Method . . . . . *by L. H. Rhodes*

Electrical Circuits for Automatic Tools . . . . . *by P. H. Winter*

Tools and Their Importance to Our Economy . . . . . *by W. J. Fisher*

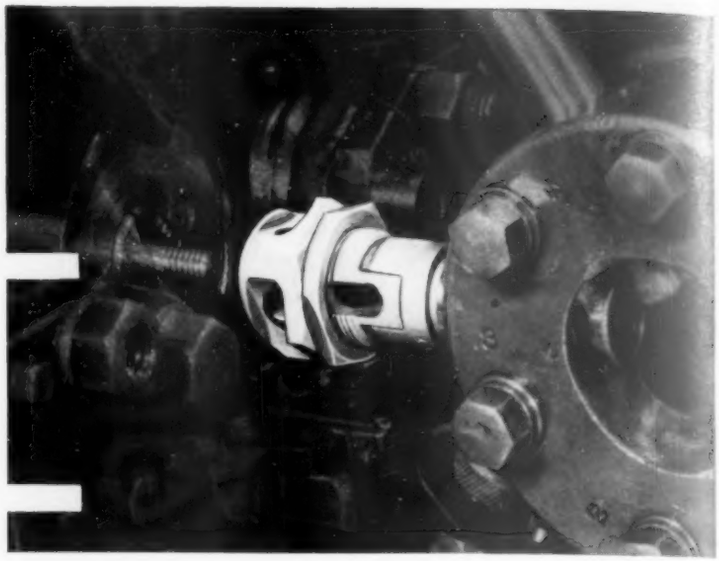
Standardization of Gages . . . . . *by Henry J. Barten*

Fellows Introduces New Lead Measuring Instrument . . . *by Anders Jansson*

Boring and Facing Head Speeds Production . . . . . *by Fred W. Steiner*

Departments

A.S.T.E. News • Andygrams • Gadgets • Fundamentals of Tool Engineering • Good Reading • Bulletins • Tools of Today • North, East, West, South in Industry • Index to Advertisers



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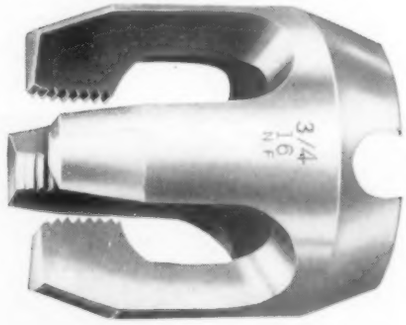

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THE TOOL ENGINEER

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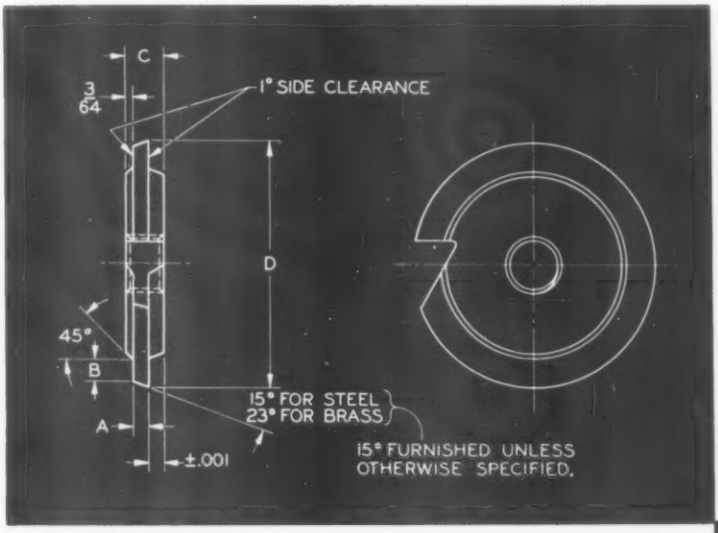

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00	00C-046	1/4"	.046"	.135"	1/4"	1.750"	4.50
00	00F-031	3/8"	.031"	.197"	1/4"	1.750"	4.50
00	00F-046	3/8"	.046"	.197"	1/4"	1.750"	4.50
00	00F-062	3/8"	.062"	.197"	1/4"	1.750"	4.50
00	00X-062	1/2"	.062"	.260"	1/4"	1.750"	4.50
00	00X-078	1/2"	.078"	.260"	1/4"	1.750"	4.50
00	00X-093	1/2"	.093"	.260"	1/4"	1.750"	4.50
0	0C-062	3/8"	.062"	.197"	5/16"	2.250"	$ 5.00
0	0C-078	1/2"	.078"	.260"	5/16"	2.250"	5.00
0	0F-062	5/8"	.062"	.322"	5/16"	2.250"	5.00
0	0F-078	5/8"	.078"	.322"	5/16"	2.250"	5.00
0	0F-093	5/8"	.093"	.322"	5/16"	2.250"	5.00
2	2C-062	3/8"	.062"	.197"	3/8"	3.000"	$ 6.00
2	2C-078	1/2"	.078"	.260"	3/8"	3.000"	6.00
2	2C-093	5/8"	.093"	.322"	3/8"	3.000"	6.00
2	2F-062	1"	.062"	.510"	3/8"	3.000"	6.00
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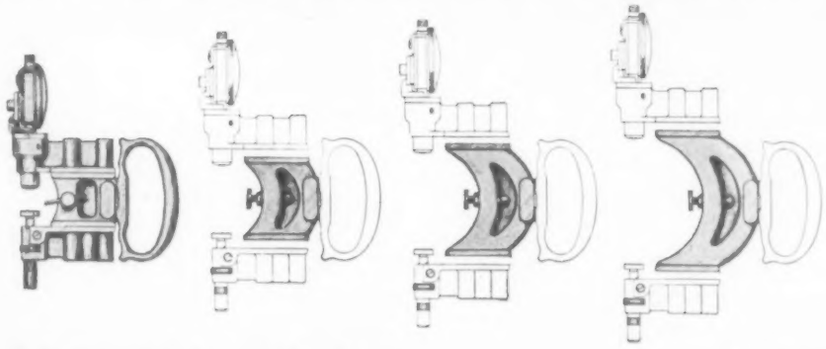

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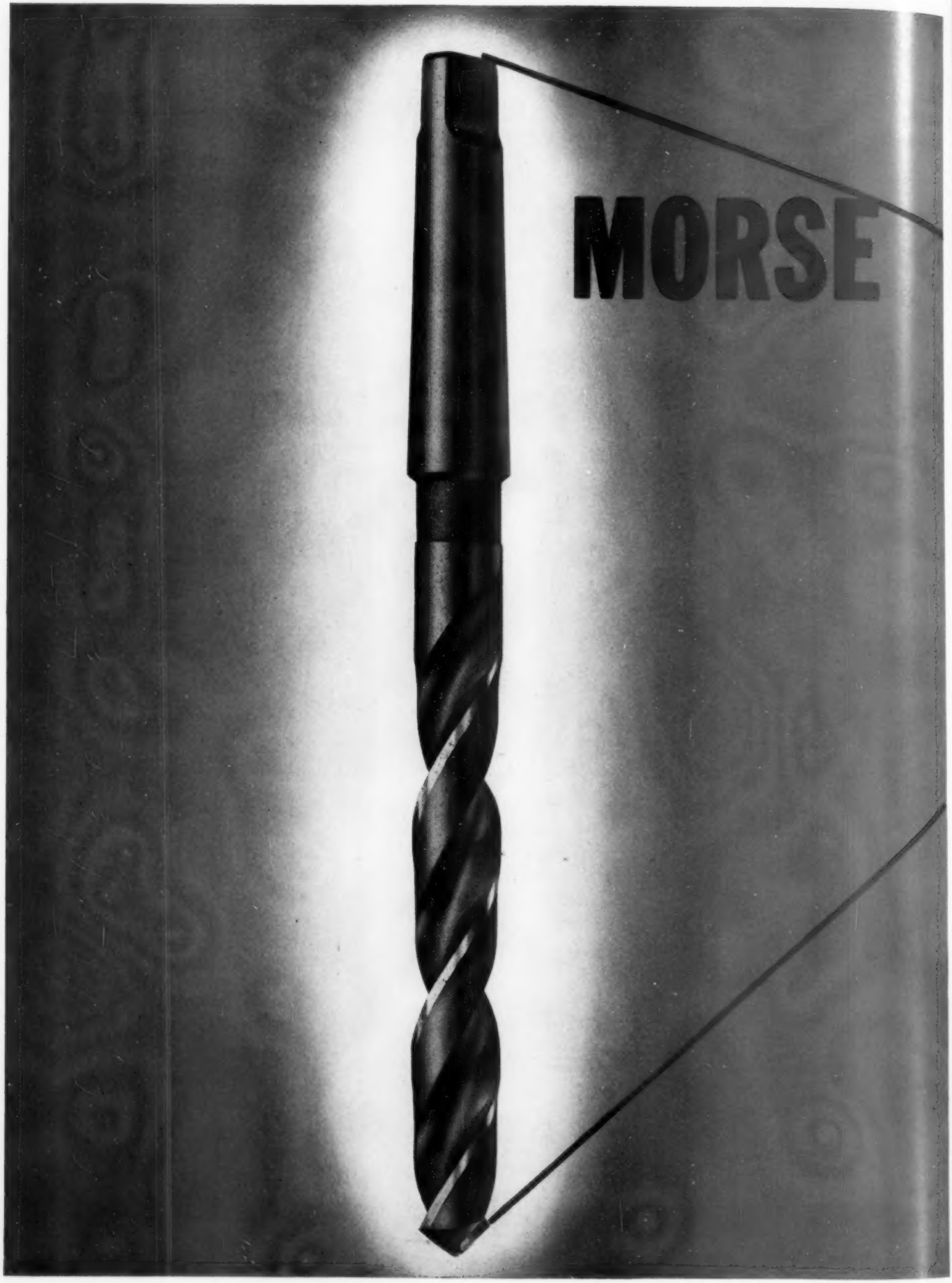
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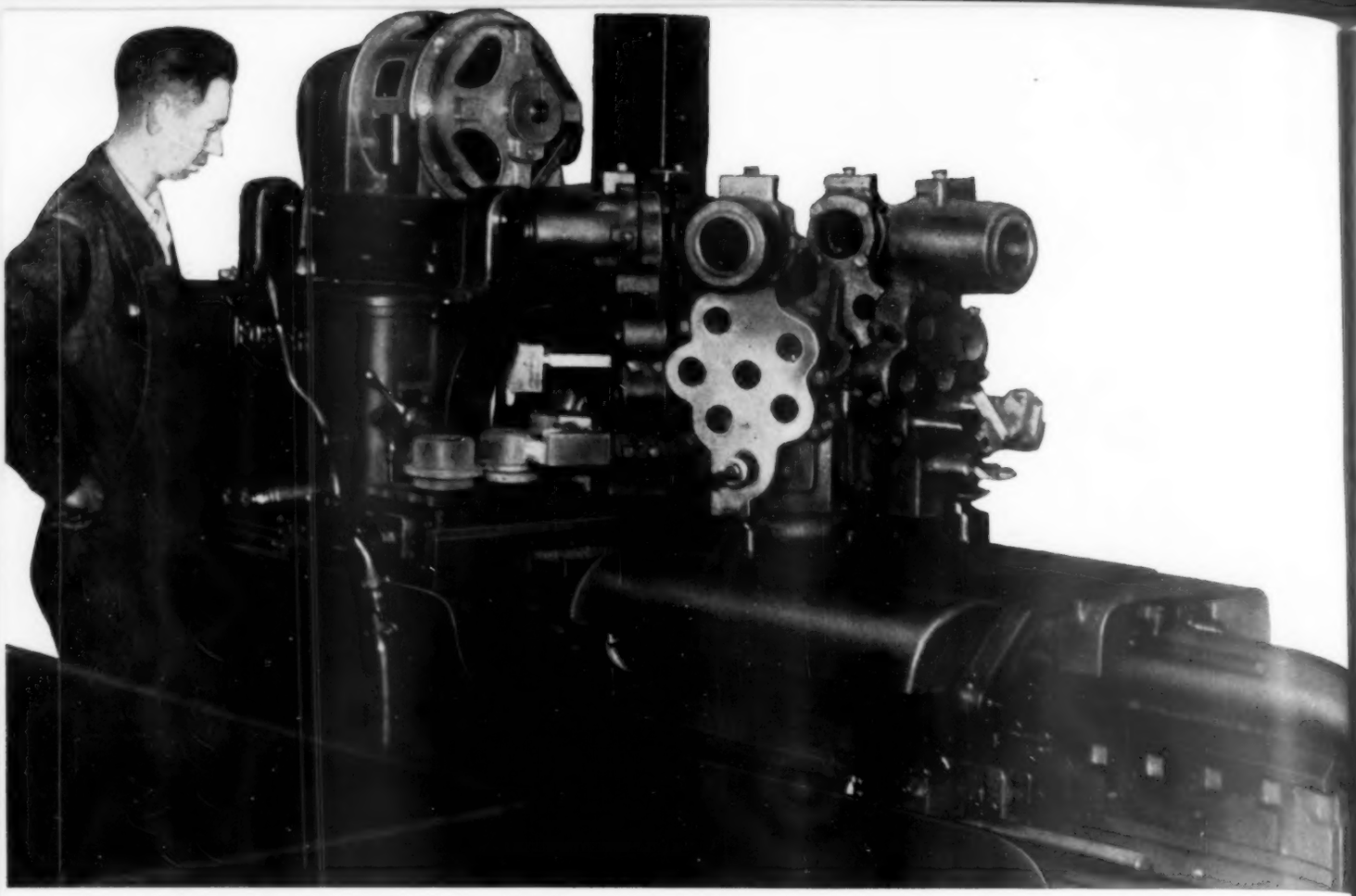

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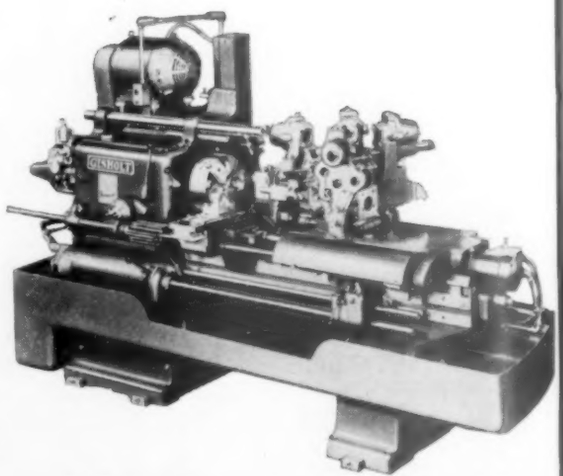

***The Fastermatics** are universal automatic turret lathes, equipped with a hydraulic feed system automatically controlled by standard feed cams. Cross slides are individually controlled and can be engaged for simultaneous operation with turret tools. Literature on request.*

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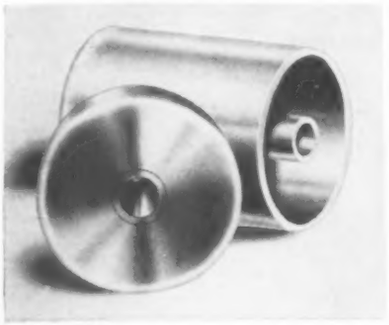

Faced with a need for speeding up the silver soldering of a cup-and-tube assembly, one manufacturer called in Lepel engineers. Induction heating coils were designed to join six assemblies simultaneously. Jigs were designed to hold the prefluxed parts of the assembly and the silver rings in position for soldering.

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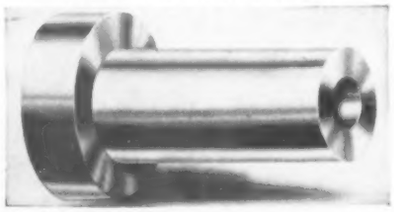
SPEED-UP OF A SHRINK-ON



A manufacturer of machinery speeded up a shrink-fit operation by applying his Lepel Induction Heating Unit to the job. The collar to be shrunk onto the tube was placed in a suitably designed load coil, and heated for a few seconds. Then the tube was inserted and the assembly allowed to cool. This is only one of the 25 operations performed by Lepel units in this one plant, which result in a saving of over 50,000 man-hours annually.

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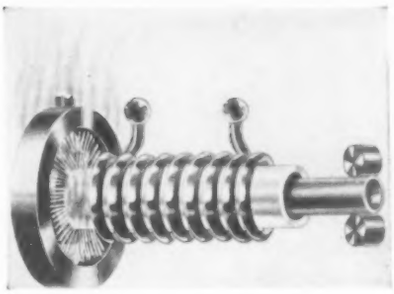
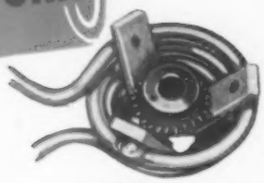
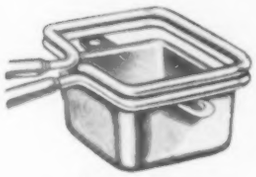


A stainless steel tubing is heated to about 2000° F and quenched in water for hardening. A tubing company is hardening such tubing at average rates of from 8 to 10 feet a minute. Heart of the automatic machine which performs this continuous heat-treating operation is a Lepel High-Frequency Induction-Heating Unit. A pair of rollers feed the tubing through a suitable heating coil and from there to the quench. One important result of this method of hardening is elimination of distortion, always a difficult problem in heat-treating.



HARDEN



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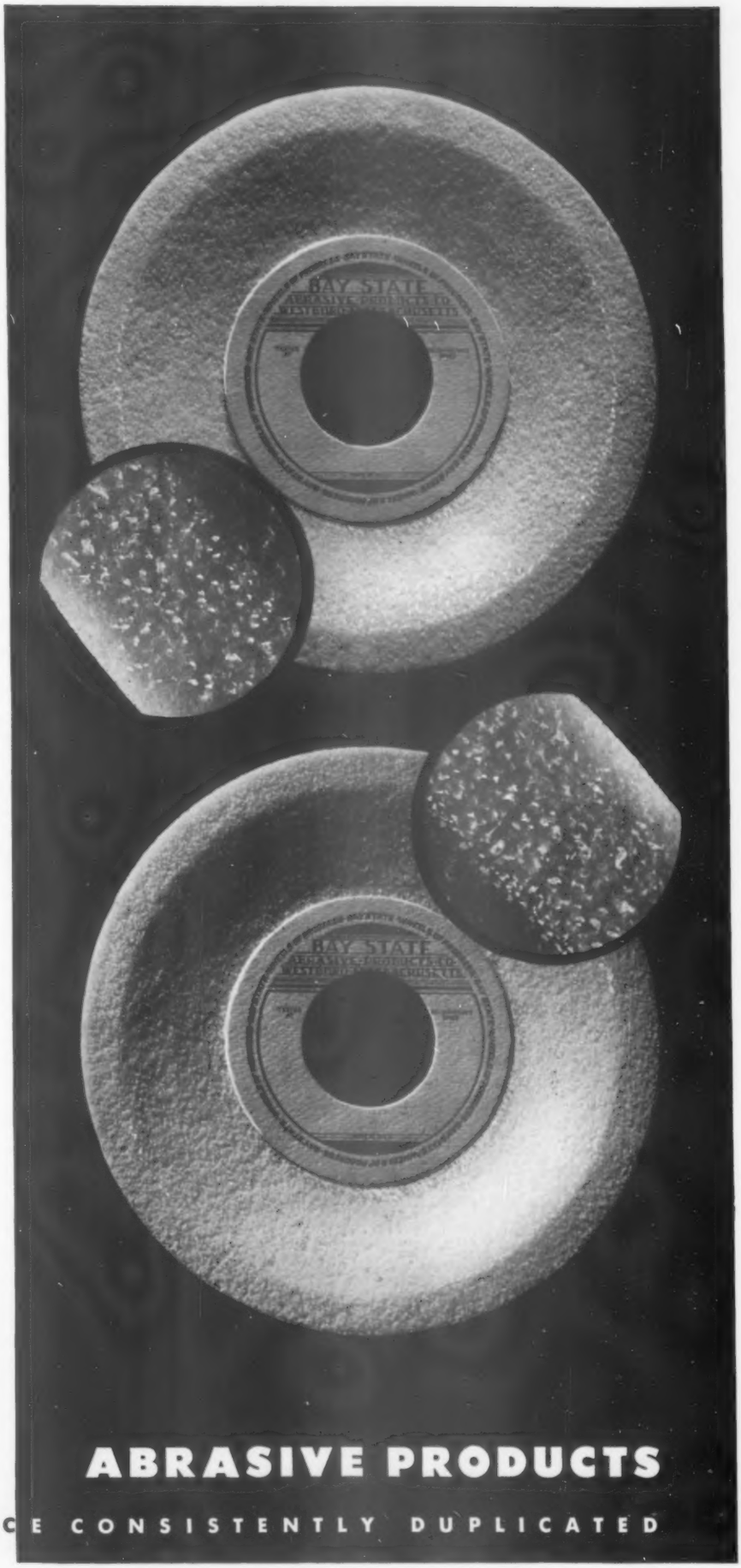

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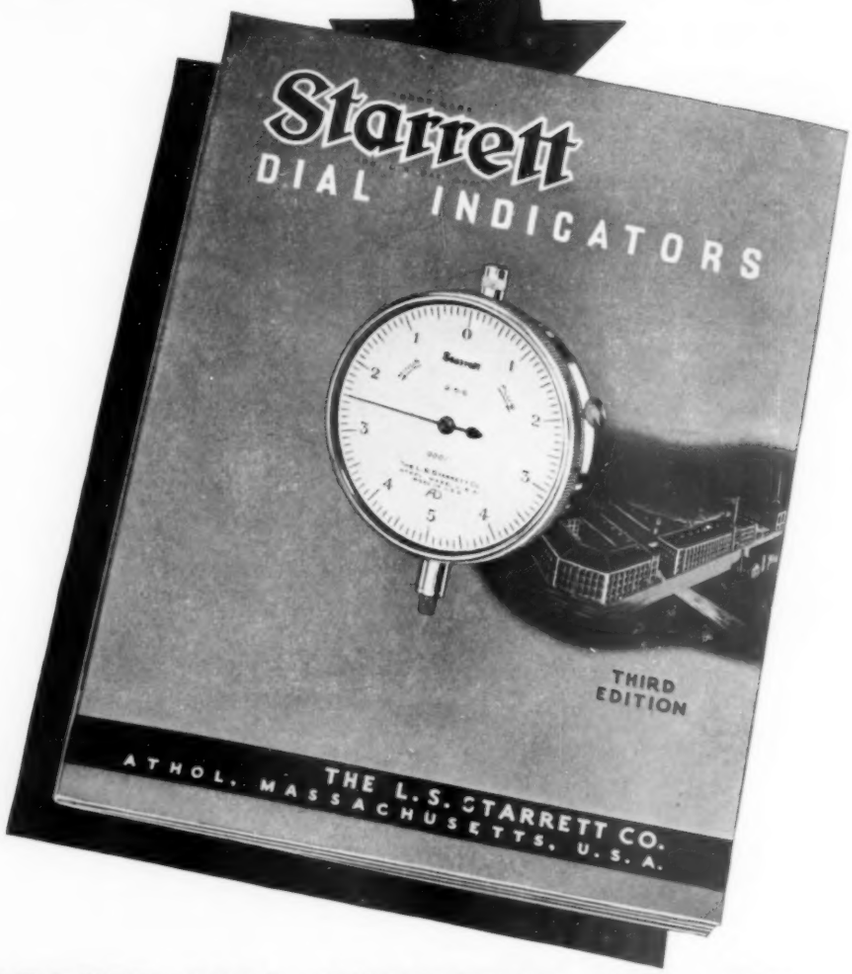

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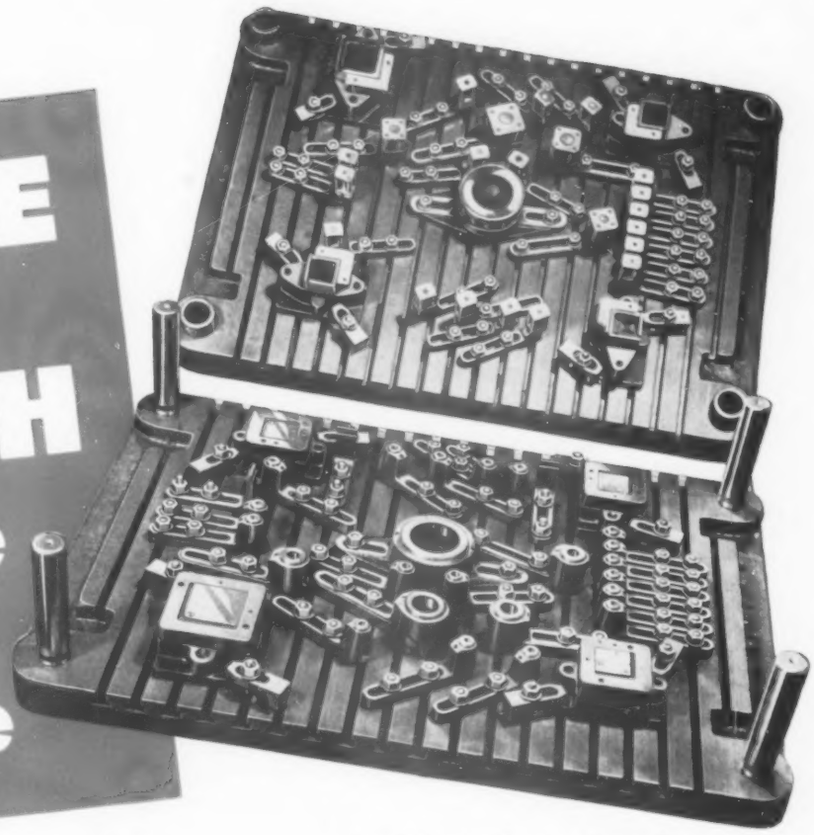

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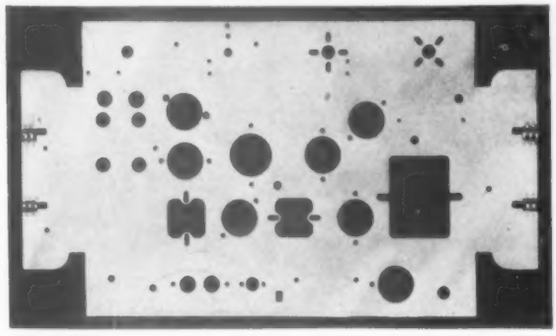

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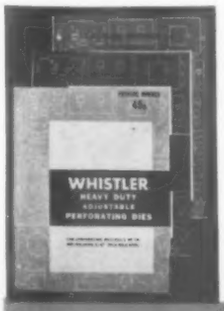

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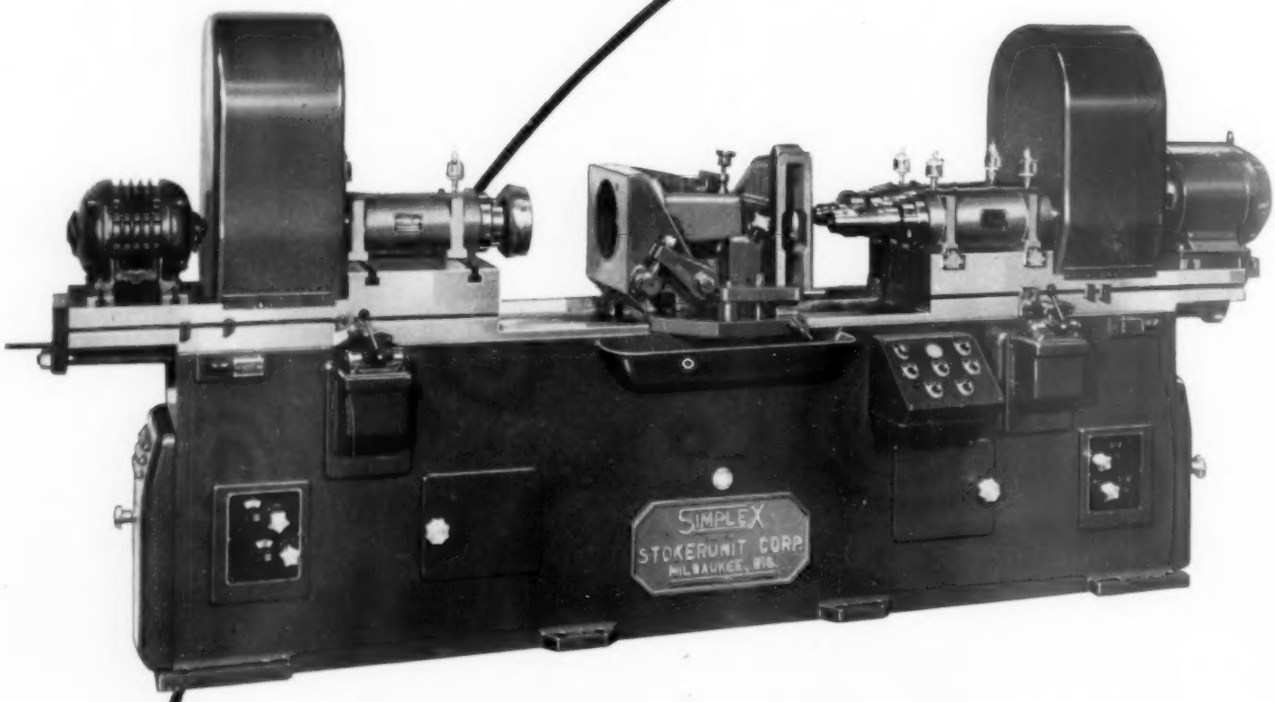

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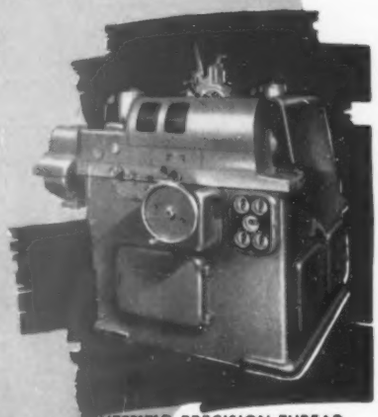

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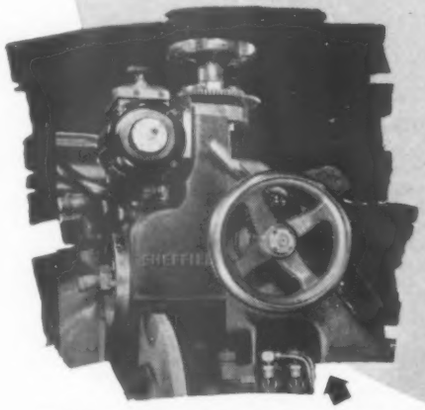

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Editorial

« America Produces For Prosperity »

WE IN AMERICA stand today at the fork in the road. One way leads to stagnation . . . the other leads to progress and better living for every American.

In pursuing progress, we must first subscribe to the American practice of distributing wealth through higher wages to those who, because of greater skill and harder work, can turn out higher production. This implies also that, in order to pay the highest wages to the best workmen, our production plant must have the most modern and efficient machinery.

It would hardly be fair to compare present production and living-standard figures, because some countries are now in the throes of reconstruction while others are in a more fortunate position. Therefore, let us examine a part of the record written just before the world became involved in the greatest war in history.

Just prior to the breaking out of hostilities, a competent investigator brought back the report that the average American coal miner produced twice as much as a German and more than 2½ times that of a British worker. American blast furnace production, per worker employed, was 3 times that of Germany and 3½ times that of Britain. In the production of steel products, including automobiles and appliances, the ratio exceeded 4 to one. For each American craftsman employed, 5 radio sets were produced to every one in Britain, and 7 to one when compared with the radio industry in Germany.

The only plausible answer is, of course, that the American worker is supplied with more and better tools and machines with which to work. An average investment of more than $6,500 is made for each worker in the metal processing industries. The plant investment in the chemical industries exceeds $15,000 per employee. Even though such plant investment figures run through most of America's industries, large and small, there is still room for vast improvement . . . and through this improvement living standards can be further increased.

Through greater productivity, the American workman has more and lives better than the working man in other countries. His pay is higher and the things he consumes are cheaper. For instance, a radio that cost an American factory employee an average of 59 hours of pre-war work cost the German 134 hours, and the Italian 333 hours. Added to this, the American has shorter hours, lighter work and better working conditions.

It doesn't take a mathematician to figure out why there was one radio receiving set for every 2.3 persons in the United States against one to 5.2 persons in Great Britain; one to 7.5 persons in Germany, and one to 45.2 persons in Russia. While the United States had one automobile in use for every 4 persons, the ratio was one to 8 in France, one to 29 in Sweden, one to 252 in Russia, and one to 1,344 in Bulgaria.

It stands to reason that if refrigerators, radios, suits or alarm clocks go down in price, as a result of more efficient and mechanized production methods, every worker can more quickly afford these items. Likewise, when wages go up in proportion to efficiency, more of these commodities can be sold. This method of providing higher living standards is the creed and philosophy of America's Tool Engineers.

Figures serve only to illustrate that progress and high productivity are always synonymous; that our production and living standards go hand in hand. We can increase our living standards by tenfold if we increase proportionally our production efficiency.

But there is still a lag.

The cutlery industry, for example, has done little to improve its manufacturing methods since the days of Paul Revere. Office equipment, farm implements, furniture, lighting fixtures and motorcycles are but a few of the industries that have lagged behind in the passing parade of mass production. Most of our mining operations are still not properly mechanized.

While new horizons of opportunity are being opened up by new industrial techniques, new materials, new products, and — most important — new capacities for consumption, right now is the time for these and other industries to take inventory of their production methods. More than half of our production machines, even at the war's end, were more than 10 years old. This should not be.

Today, enlightened industry is gearing itself for low item profit on a great turn-over because it realizes that under predominately free enterprise, for the first time in history, we have developed the physical foundations for true abundance. In this transition, the Tool Engineer will enhance enjoyment and open up new vistas of good living by helping to provide more and better goods for less money.

Am Largent

President 1946-47

By Walter J. Brooking

Tooling for Arc Welded Production

Correlation of Design and Practice Begets High Quality and Economic Advantage

WITH THE INCREASE of arc welding for the manufacture of machinery and equipment, during the past few years, the training of capable tooling experts for welding control and processing has become of increasing interest to the industry. The situation presents many peculiar and challenging problems to the tool engineer.

The fundamental idea of engineering and tooling for welding is that by scientific, objective study and evaluation of the elements involved, a choice may be made, or a method developed, which is demonstrably better than other possible choices or processes and which would result in economic advantage either in cost or quality of product.

Walter J. Brooking **is a graduate of Whitman College, Walla Walla, Wash., and University of Chicago. Joining R. G. LeTourneau, Peoria, Ill., in '35, he was assigned to time study on welding, then, transferred to the engineering division was successively promoted until, in 1943, he became Director of Testing and Research. He is a past chairman, Peoria section of the American Welding Society, an active member of Peoria Chapter, A.S.T.E., and author of numerous articles on welding as well as of a book—"Arc Welding, Engineering and Production Control"—published in '44.**

Many of the problems encountered in mass manufacturing heavy earthmoving equipment—such as shown in Fig. 1—are somewhat different from the manufacture of airplane fuselages or ships. Also, the problems encountered in mass production shops is naturally different from that of an organization which operates as a large job shop producing special machinery built to special order.

FIG. 1. Wheel type tractors and earthmoving scrapers, examples of modern mass production of arc welded equipment are produced in lots of 100 or more, per order, by specialized workmen on modern manufacturing and assembly lines.

However, large mass producers of welded equipment encounter many problems similar to those met by specialized shops, especially if they build special shop machinery or fixtures such as shown in Fig. 2. The design, engineering and manufacture of these special shop units bring up problems which, in many respects, are faced by the large job shop.

In considering the work of the tool engineer, for welding, it should be kept in mind that, in some organizations, the various fields of operation may center around one man, or a small group, and may be widely shared by many people in other organizations. A general analysis of the operations and functions which must be performed in the production of welded equipment, either on a mass production or job shop operation scale, will tend to illustrate the tooling and engineering functions which someone in the organization should understand and be able to perform.

With this in mind, the following list of general operations and problems of organization, which must be dealt with, occur in arc welded production.

1. Outline welding processes and select equipment. 2. Evaluate and select appropriate welding electrodes for all processing done in the plant. 3. Correlate welding design with practical shop practice and available shop equipment. 4. Tool up for flame cutting, sheering, coping or punching of individual parts from raw material. 5. Create bending, forming or shaping dies and fixtures for shaping the various

FIG. 2. Mass producers of arc welded products have many typical "job shop" jobs, such as this unit designed to flame heat and quench sheave wheels automatically. The first of four similar work stages is shown.

parts to the form in which they are to be assembled into the final welded structure. 6. Create production fixtures for welding (setting up and positioning for welding). 7. Establish the general procedures for welding the company's products. 8. Establish production control of procedures in detail. 9. Establish quality control (inspection). 10. Provide the tooling and planning to accommodate the peculiar problems arising in the machining of welded products. A detailed breakdown of each of the ten groups will now be undertaken.

Fundamental procedures for manufacture by the arc welded method having been decided upon, there still remains the problems as to what type of welding equipment should be used.

The question as to whether alternating current or direct current machines should be purchased is strictly a welding engineering problem. Based on a study of material, power, or type of welded product, someone in the organization must know or find out—whether the use of a.c., from a transformer type welding machine, (such as is used by the welder in Fig. 3 for the mass production of a part of a heavy earthmoving machine) or a motor generator type d.c. welding machine is more practical for that particular organization.

The size (or capacity) of the machine must also be determined, taking into consideration the type and variety of work which is to be done, with special attention to variety of sizes and types of electrodes and relative continuity of use. In order to test and evaluate machines within a group of fundamental types (ac transformer or dc motor generator or automatic welding) the man assigned to this work need not necessarily be a full fledged electrical engineer although certain considerations of power consumption, efficiency and equipment investment require analysis which is of a rather technical nature. However, all this may best be accomplished by objective comparative tests, plus examinations of the machines from a mechanical viewpoint.

Record of Performance

Such tests should always include actual deposition in which a certain number of electrodes are used, or a quantity of welding done under controlled conditions. Whenever possible, they should include careful, over-all consumption studies, using a recording kilowatt meter or some other means of determining the amount of power used and the amount of time (labor) required to deposit the metal.

Such tests should also include a study of the extremes in setting and operating of the machines, such as the lowest amperage possible to obtain and, therefore, the smallest electrode usable as well as the reaction characteristics of the machine at very low settings or very high settings. Another thing which the recording kilowatt meter may be used to determine is the comparative speed with which a welding machine may be brought to its peak efficiency after the arc has been struck. Fig. 4, which shows such a recording of the arc striking characteristics of three separate machines, demonstrates a very noticeable difference between them.

Other equipment, besides welding machines—such as hoods, cover glasses, electrode holders, cables, cleaning brushes and slagging tools—must also be selected and evaluated. In addition, methods of grounding welding machines, and arrangement of machines in the factory proper for efficient welding,—i.e., plant layout—are also related problems requiring study. While these problems offer a variety of solutions, only objective tests can determine which best meets the needs of a particular organization.

Evaluate and Select Welding Electrodes

Since welding electrodes are fundamental raw materials of the arc welding process, and since the weld metal deposited in the weldment becomes an integral part of the product, the electrodes alone present a very important field for objective and detailed study. There are, therefore, considerations about electrode selection which are of considerable importance on any job.

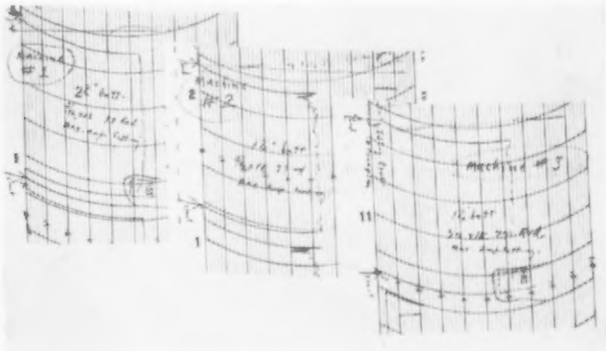
One of these is that the electrodes must be selected for the type of material being welded and the welding equipment used, with due considerations for the average skill of the welding operators in the organization. For ordinary steel welding operations, on a mass production basis, there may be special physical requirements which must be met by the electrodes. In such instances, they may be tested by control agencies outside of the organization, but, someone in the organization should understand the fundamentals of selection and testing of electrodes, if only as a part of production routine.

Another major consideration, in electrode selection, is that of using the electrode best adapted to the common positions in which welding is done in the plant. As, for example, downhand welding using AWS class E-6020 type electrode (for ordinary low carbon steel) and E-6010 or E-6012 electrodes for horizontal, vertical, or overhead in order to most economically deposit the weld metal. See Fig. 5.

The consideration of special types of electrodes, such as special hard-surfacing or high tensile electrodes to meet special needs in the manufacture of equipment or maintenance of regular manufacturing machinery, also warrants

FIG. 3. Selection of the best type of equipment, for mass production welding, is one of the problems in tooling.

FIG. 4. Automatic recording equipment for testing welding machines or electrodes. Note that Machine No. 2 rises immediately to full welding current delivery after striking the arc, while Nos. 1 and 3 lag in output for several seconds.



studies which should be made by the organization in the interest of getting all possible economy from arc welding.

Comparative tests of electrodes within a certain type (such as comparing the E-6010 electrode produced by various companies), as applied to special welding problems, constitutes another effective source of economy if approached from the engineering standpoint—that of controlled, scientific measurements and tests. This phase of tooling for welding is not one to be considered and then forgotten; rather, it requires periodic re-examination and testing in order that the organization may be assured that, at all times, it is following the best practice and using the electrodes best adapted to their particular type of production.

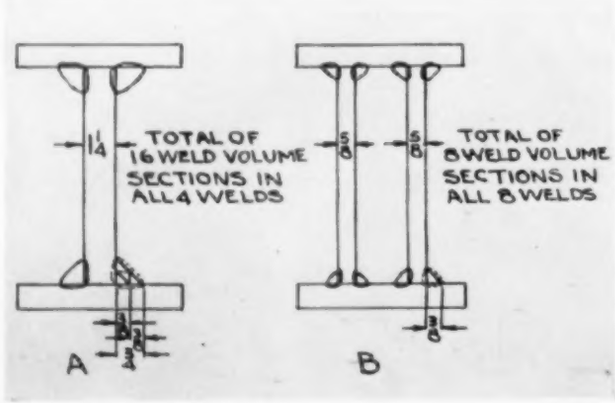
These tests always have two phases. The first is that of operating characteristics from the standpoint of ease of handling, speed of deposition, and ease of slagging as seen from the welder's viewpoint. The second phase is that of economic advantage which involves the original price of the electrode, the percentage deposited and the actual cost of the finished unit of welding as affected by the electrode.

Correlate Design, Practice and Equipment

While it may be assumed that the function of designing welded equipment should be a prerogative of the engineering department alone, there are certain considerations where knowledge and experience of the several departments of an organization should be pooled.

FIG. 5. Regularly run and carefully controlled (stopwatch, rule, ammeter, and weighing balance) electrode comparison tests provide economic margins for manufacturers of arc welded products.

FIG. 6. Relative strength of welds should be widely known in a welding organization. Here, the total web sections in "A" and "B" are equal in strength, but only one-half of the weld metal (and time and cost of welding) is used to fuse the web section in "B" as compared to "A".



For example, the capacities of machines in the plant—as shears for cutting parts from plates, the overall capacity of flame cutting units, bending brakes, rolls, or presses—are important items in the production of parts for welding and have a distinct bearing upon certain details of design.

The relationship of volume of weld metal to increase in lineal dimension of weld, as shown in Fig. 6, is also a matter to be shared by the manufacturing and engineering departments. While essentially a phase of engineering, it may be important to know that two pieces of steel, welded into a structure in such a way that their individual strength is doubled, requires twice the amount of weld metal to fuse it into a structure having twice the strength of the single piece.

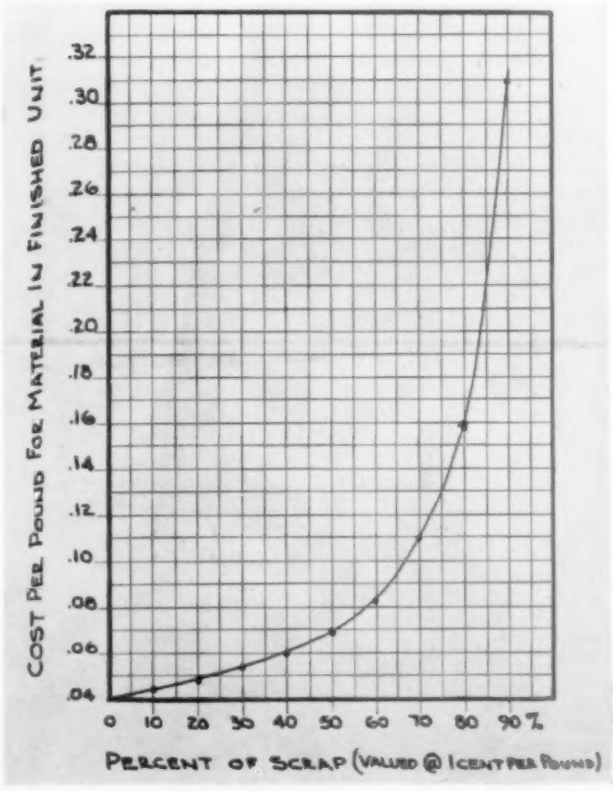
Control of Material

It may be that equipment is available which will handle plates equal to half the total strength required, but won't handle a solid plate equal to the total strength. It may be, also, that the additional work involved, in making two of the thinner pieces, will actually cost less money than deposition of the double quantity of weld metal required for the single thick piece.

Another important phase of tooling for welding is that of controlling the use of materials. The original raw material used for welding as (steel rolled at the mill) is a relatively inexpensive material in itself; however, the extent to which it is utilized in the final product, compared to the percentage sold as scrap, has an important bearing on the total cost per pound of material. See Fig. 7.

Careful planning of raw material purchase, to allow for the most economical cutting of parts, is an important consideration. A careful study of the shapes to be made, in relation to the raw material, is the first step towards its

FIG. 7. The increase in cost of material in the finished unit caused by charging scrap loss to the material used. Normally at least 75% of the original value of material is lost when it becomes scrap. This should be added to the cost of the material used.



economical use. Especially so, since many of the most effective welded designs require irregular shaped parts. A careful study of the arrangement of such parts, with a view to the least possible cutting and scrap, together with the most economical layout sketched in on the original parts print, as shown in Fig. 8, is a lucrative step in tooling for a specific welded design.

Careful utilization of left over parts, as when shearing small parts from plate scrap, also helps to reduce the percentage of scrap and therefore provides an over-all cheaper material for the finished unit. Another fundamental consideration, in engineering for welding design, is the determination and control of the correct amount of welding on certain types of joints. On some kinds of welded units as much as 90% of the joints are of the "T" joint type, or fillet type joint, where the legs of the weld may easily exceed the thickness of the plate to almost any degree to which the operator wishes to deposit metal.

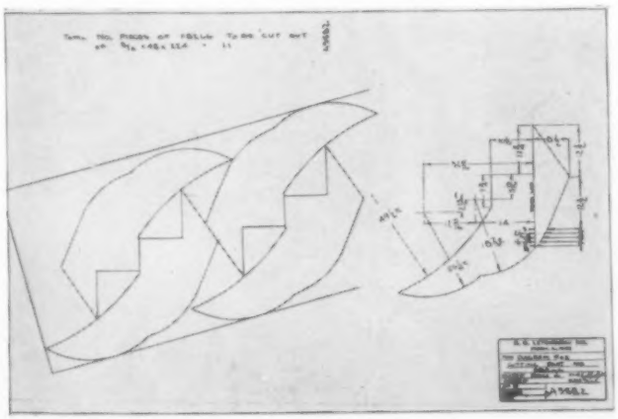
Increases in the size of the weld on "T" or fillet joints results in increases in volume of weld metal—and cost—by the cube rather than by the lineal dimensions as shown in Fig. 6. That is, if the size of the weld is increased only one half its normal size, considerably more than twice the amount of time, power and weld metal are required to weld the joints. Knowledge of these fundamentals, on the part of the organization in general, tends toward more economical engineering and construction. Any design, made to cost less, and without reduction in quality or strength of the unit, may be considered a good piece of engineering.

The weldability of different materials which may be included in design, and the relationship of the welding process to the chemistry and metallurgical properties of the materials in the structure, are problems which affect not only the original design of the structure but also concern the members of the organization who are engaged in cutting, shaping, heat treating, machining, and other processing of the product.

Tooling for Cutting of Parts

Tooling for flame cutting, shearing, coping, or punching of parts for welding—that is, for the various processes of cutting parts from the raw materials—presents an interesting group of problems to the tool engineers. One very important process, which goes hand in hand with modern arc welding, is the flame cutting operation which uses such automatic cutting machinery as the large three torch unit shown in Fig. 9, or a small magnetic type flame cutter such as shown in Fig. 10, or manual cutting with a hand torch.

FIG. 8. This working drawing not only shows the part, but also shows the shop how to plan cutting of specified material to produce the most parts with the least scrap.



The production of templates, for all flame cutting operations, is an important step in tooling for arc welding and requires carefully controlled engineering as well as a high grade of workmanship. Fig. 11 shows three different types of templates which are commonly used in mass production of parts for arc welding, each requiring a different type of manufacture and each representing a degree of permanence.

A very important part of tooling for manual flame cutting, of which there is usually a certain percentage which can not be readily accomplished by automatic machines, is the provision of special template fixtures to be used as a guide in the manner shown in Fig. 12. These templates provide markers which outline the parts and also provide mechanical guide-ways for the operators, greatly reducing fatigue and improving the uniformity of the flame cut parts.

For punching, blanking, shearing or coping operations, the tools and dies for large quantity production fall pretty much in the conventional line of tooling. For moderately small numbers of repetitive operations, however, and even for large quantities up to fifty or a hundred thousand pieces, it is often economical to flame cut dies for punching, shearing, coping or blanking from plates and to hard surface the cutting edges of both the punch and die.

Dies of this type need seldom be placed in a toolroom since they can be flame cut and hand-ground very inexpensively by a good welding and flame cutting operator without entailing heavy toolroom expense. They can be made to clamp or bolt onto a press and sometimes even the bolt holes may be flame cut.

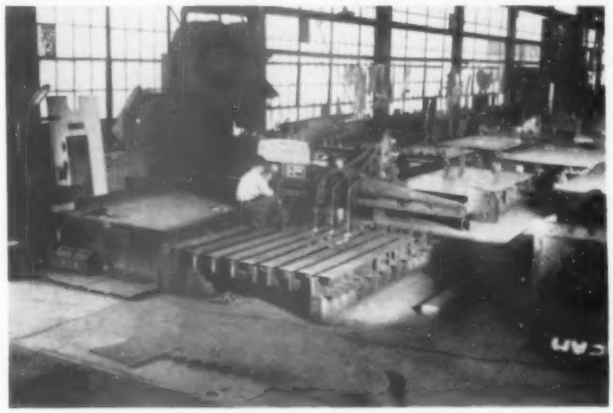


FIG. 9. Three multiple-flame shape-cutting machines in production. Templates used with machines such as these must be accurate in size and form for consistent production of cut parts on a quantity basis.

FIG. 10. A magnetic flame cutter in operation. A few templates may be seen in the background.

A particularly challenging source of economy, in tooling for arc welding, is the bending, forming, shaping and contouring of parts after they have been cut from the raw material and prior to their being welded into the final structures. Bending brakes and bending rolls, spinning operations and forming or shaping with dies, in heavy presses, are the usual means for forming or shaping these parts.

Create Forming Tools and Dies

There are many advantages to such contouring and forming, and the larger the number of individual units of a certain type which are being made, the greater the opportunity for economy as a result of such operations. Weld metal is expensive, and wherever a welded joint can be eliminated by a forming, contouring, bending or rolling operation which will distribute the raw material in such a way as to provide the requisite structural strength, it is likely to result in marked economy and, often as not, in a pleasing appearance. Also, the saving provides a good margin for additional tooling if done under closely controlled conditions and as a result of carefully evaluated studies.

Brake bending, in preference to joining two pieces, often results in simplification of design and is especially advantageous in fabricating experimental units before they are standardized for mass production. See Fig. 13. For such press working operations as bending, drawing, forming, shaping and dishing, the type of die construction previously described for blanking and shearing should also be borne in mind. However, some machine work may be necessary on turning or forming dies for complex contours on certain parts which may have to be pressed hot or cold. See Fig. 14A.

If, however, the die building program for bending and shaping parts for arc welded construction implies maximum use of flame cutting and welding of the die elements, with hand grinding for smoothing the flame cut surfaces, a large percentage of these dies (such as shown in Fig. 14B) can be made outside of the toolroom with simple tools. These dies may be clamped or bolted into presses with a minimum of machining.

The fact that the stock, from which such dies are made, is almost invariably rolled flat on at least two sides and perhaps four, eliminates much of the expensive cleaning, shaping and milling necessary on conventional dies.

Since the parts of many welded structures are shaped by pressing or brake bending, it is well to provide checking templates to allow the workman to check his work as he goes along, to insure accuracy. Fig. 14C shows an operator using a light metal template to check a curved part which will become a side member of a curved box section. Such templates are easily made and similar devices may be developed for the quick gauging and checking of many pressed or formed parts.

Since rolled press forms or otherwise shaped parts, which go into a welded structure, usually contribute considerably to the end shape and form of the unit, it is important that the tool engineer provide such templates for accurate contouring so that structures will be standard as to form and uniform and accurate when the joints are fitted together for welding.

Create Production Fixtures and Tools

Each separate welded structure should be studied, individually, with the object of assembling the parts more quickly, positively, and efficiently, and of positioning the unit for welding in the most favorable position possible. This study also includes the possibility of pre-machining the parts, prior to assembly and welding, as a phase of tooling. (See Fig. 15.)

The effect of heat, in welding, and the resultant distortion and locked-up stresses, also warrants study of the structure with a view toward designing the most efficient fixtures. Often, structures may be made into several subassemblies in order to achieve more favorable positioning

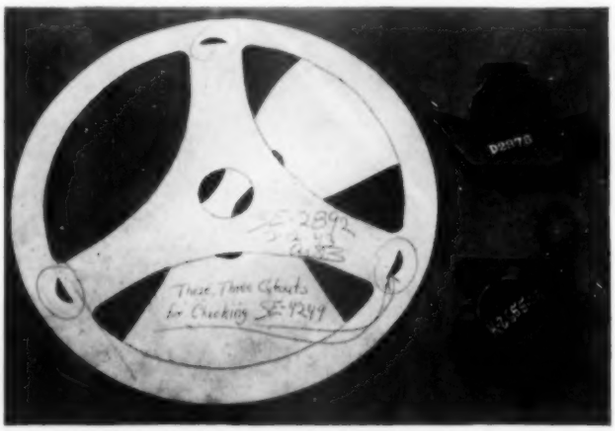


FIG. 11. Three types of templates for mass-production flame cutting. The large one on the left is cardboard and is used to trace cuts with the multiple flame-cutting machine for only a few pieces—i.e., 10 to 30 or 40. The template at upper right is for large numbers of pieces mechanically cut, and that at lower right is a special metal template for cutting pieces by hand.

FIG. 12. The special template fixture used here provides for making accurate flame cuts on complex parts without previous layout. It also provides the operator with a guide, to steady and control the cuts with a minimum of fatigue and lost motion.

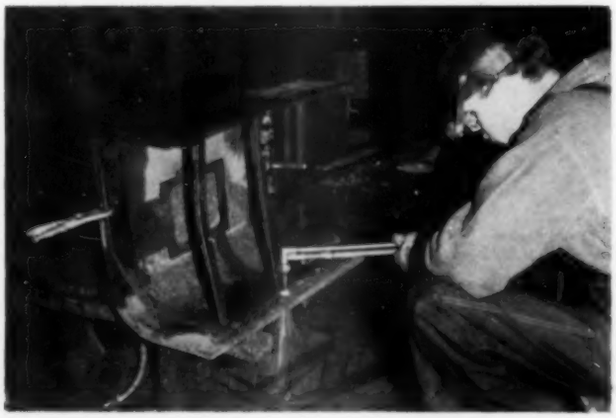


FIG. 13. Machines such as this bending brake reduce the total amount of welding on arc welded products and help to effect overall economies.

during the welding process (a large percentage of welding is in the downhand position) or in order to reduce the handling and to increase the ease of machining certain parts which cannot be totally pre-machined.

The use of time study methods, to establish the difference in cost between downhand and horizontal fillet welding, or between vertical and overhead welding, is one of the best means of establishing the amount of added efficiency which can be achieved by positioning weldments for downhand or for more favorable welding during their manufacture. It is commonly found that a 25 to 50 percent reduction, in time and cost of welding, can be achieved by the use of positioners. Especially so in the case of welds that, ordinarily, would have to be deposited in the vertical or overhead position but which, by use of positioners can be positioned for flat or horizontal welding.

Procedures for Welding

After the fixtures have been built, a step-by-step procedure for setting up and welding naturally follows. When product is made on a mass production scale, operation sheets—such as shown in Fig. 16—giving the individual steps in proper sequence, should be made up so as to minimize or control the effect of distortion from the heat of welding.

These sheets provide an engineered set of specifications for the operator, which answer such questions as: "Which part shall I set up first?" and, "Which weld shall I make and in what order?", and therefore allow for standardization of procedures. In the case of the production of an individual machine, or of a few, such planning is essential, although it is likely that it will be done by the special setup man who is building the unit. However, procedures may preferably be outlined by special notes on the print from which the setup man works.

Unless there is step-wise planning of production procedures, the fixtures which may be available for use in the manufacture of sub-structures may not be used to best advantage. Hence, the maximum efficiency which should accrue from the fixtures will not be realized. From the standpoint of economy, and in the interest of controlled appearance and standardized products, such planning is an important part of tooling for welding.

Organize Detailed Welding Control

There are certain phases of detailed control in welding which, unless prescribed by written specifications, are likely to cause variance in processing which, in turn, will be reflected in variations in appearance of the finished products. Hence, it is preferable that specific information be presented for even small scale production. The details specified provide the answers to questions which the welding operators would ask, and may have answered in his mind, but erroneously, before he strikes an arc. They are briefly as follows:

1. Where should the structure be welded? 2. What size weld should be deposited? 3. What is the cross-sectional view or form of this weld when finished? 4. In what position should the joint be welded? 5. How many passes (layers or beads) of weld metal should be deposited for best welding procedure? 6. What type, and what size of electrodes should be used for the deposition of each layer of weld metal? 7. What machine setting should be used for each separate pass? The answers to these questions may, in part or in whole be noted upon the blueprint of the structure by welding symbols such as shown in Fig. 17.

In the manufacture of a single machine, or of a few, welding symbols may be used on only the major parts as the craftsman who sets up and welds the unit may be a more skilled workman, from the standpoint of welding techniques, than the man doing work on comparable units in mass production—that is, where the workman repeatedly does the same operation or series of operations, but not the whole job.

The establishment of a system for such a control (weld symbols on the blueprints) requires a certain amount of special shop education on the part of the operator in order

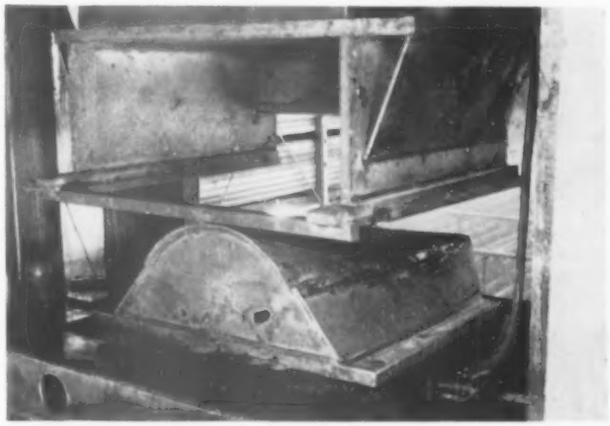


FIG. 14B. Dies for press forming parts for welded structures may be made by the simple use of flame cutting equipment, arc welding, and hand grinding.

FIG. 14C. By the use of this light-gauge metal template, the operator can check the curve of the plates as he rolls. The check up is quick and easy and insures accuracy in fit-up of parts.

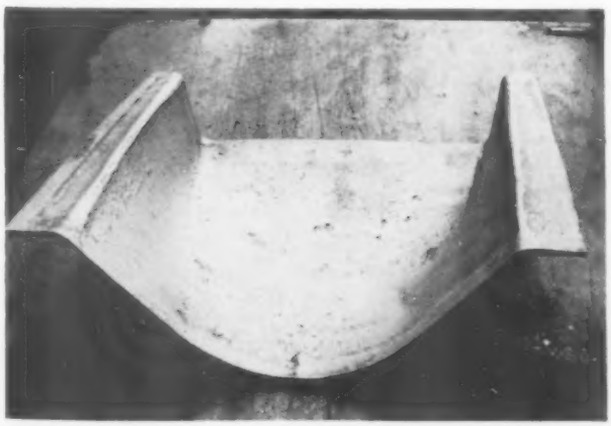
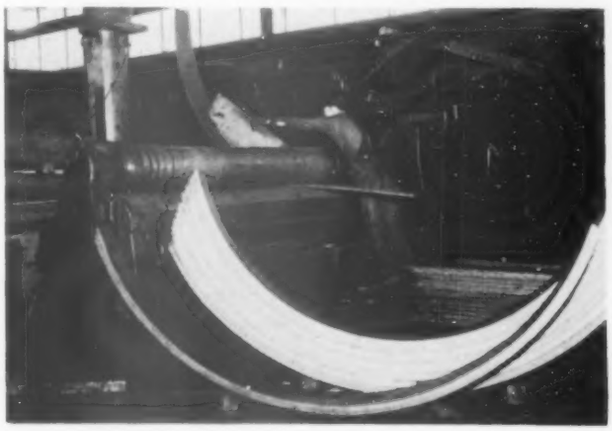


FIG. 14A. Contoured part made in the dies shown in Fig. 14B. This is ⅜" thick material and the finished part is about 36" x 50" in size.



that the information may be understood and properly followed. While this educational work is a phase of welder training which can be standardized by use of American Welding Society welding symbols—which are widely used—it also requires individual plant adaptation.

If this phase of engineering has been accomplished, the degree of control, cost analysis, cost prediction and work scheduling which is necessary for a really successful manufacturing process can be accurately maintained. Further, with this information in hand, it is not at all difficult to establish an incentive system which allows the welder to capitalize upon his own skill or efficiency of work.

One additional step must be taken, in order to make such a system a success with arc welding, and that is a continual detailed study of the fit-up of the parts on each structure, together with a crusade to keep them to a standard which is normal for the structures and therefore consistently reflected in the standardized time set for the completion of any given job.

Establish Quality Control

The problem of quality control, in arc welded products, is one which must be solved for each individual organization and each individual product. If there are complete specifications as to size and appearance and the quality of weld, a large portion of the engineering has been done because quality control resolves itself only into determining that specifications are met. Whether there are complete specifications or not, quality inspection is a "must" on any welding job. Some one in the organization must be responsible for either periodic or 100% checking of the welder's work to insure perfection of the finished product.

Inspection of welded products may be a very highly specialized process involving special techniques, prescribed by code, and requiring apparatus and skilled technicians. The X-ray, gamma ray, magnetic flux, and other special non-destructive inspection methods used on pressure vessels, military equipment and several other applications require a greater degree of specialized training, on the part of inspectors, than does the simple guided bend test or other rather simple weld qualification tests.

Another type of inspection, which is usually very instructive and which may be profitable, is that of examining structures which have failed in service. Such examination usually yields specific types of information for a welding organization. If certain failures recur frequently, it may be a weakness in the initial design of the structure, or, it may be a matter of welding technique. Only careful examination of the structures which fail will determine the causes.

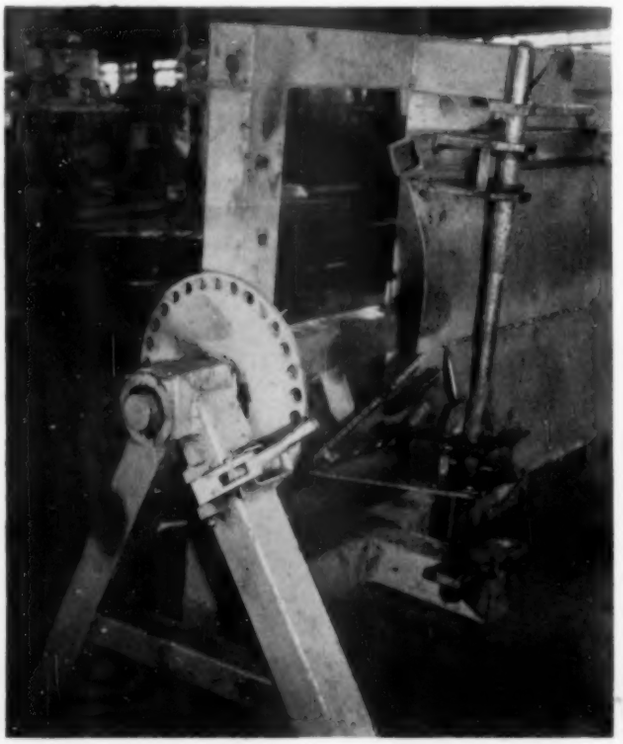
In connection with such examinations, it may sometimes be to the interest of the company—and to the individual welders in the organization—to have a system set up whereby the work of each man may be identified at any time after he has completed it, including later periods of field service.

Provide Tools for Machining of Arc Welded Products

Basically considered, the machining of raw steel, castings or forgings of a welded structure, either separately or as a unit, is not greatly different from most ordinary machining operations. However, one of the fundamental sources of economy, in arc-welding construction, lies in the relatively simple machining of parts that make up the machine.

The production of the main framework and structural parts of machinery does not comprise the only applications

FIG. 15. **Fixtures, which speed up, standardize and simplify setting up and welding operations offer real sources of economy. (Note the use of pre-machined parts in this structure, and their protection from weld spatter drops by the fixture.)**



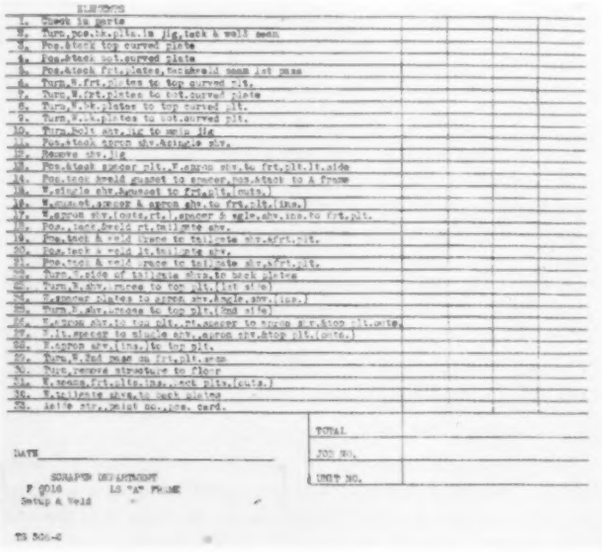
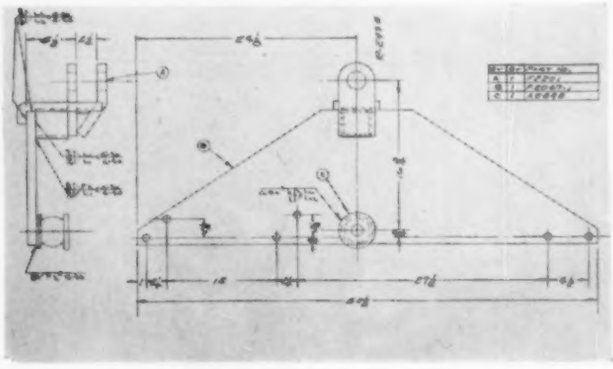


FIG. 16. **The establishment of orderly sequences of operations in the production of welded structures results in economical mass production.**

FIG. 17. **Arc welding symbols used as shown on this print convey engineering information, in exact and complete terms, to the welder, welding foreman and welding inspector.**



of arc welding. Many of the smaller parts that go into the main structure, such as gears, pinions and moving parts, shown in Fig. 18, may also be made by the welding method.

Pre-machining of parts for welded structures, prior to welding, is another economy of welded fabrication. The variety of parts that can be pre-machined, in the manufacture of arc-welded structures, is mainly dependent upon the resourcefulness of the designers and manufacturers. Fig. 19 shows a few pre-machined parts cut from commonly available steel bars, tubes, shapes, or plates prior to being welded into complete units.

The economy of pre-machining parts is obvious from the standpoint of the mechanics of machining. To handle and tool a small individual part requires considerably less labor, machine capacity, complication of holding fixtures and space than would be needed for a larger structure. Pre-machining may be a roughing operation, prior to finishing, or, it may be a roughing process for parts that will be welded into sub-assemblies or completed structures and finish machined in that form.

An advantage of this type of machining is that, by rough boring or facing or otherwise machining the parts, location points can be established by machined surfaces that will give positive location and accurate placement in the fixtures prior to welding or final machining.

Since the machined parts usually represent functional contact points in the assembly of a machine, it is essential that the parts be properly located in their correct mechanical relationship, one to the other, during the setting-up and welding process. This is true of forgings, castings, parts made from plates, bar stock, structural members or stampings alike. A machined surface gives a setting-up point, accurate to work from. It goes without saying that one of the important considerations, in welded construction, is that of accurate setting-up fixtures for the parts.

Fig. 20 is an example of a setup fixture for the location of pre-machined parts, prior to their welding, in such a way as to maintain accurate relationship between widespread functional points of the machine.

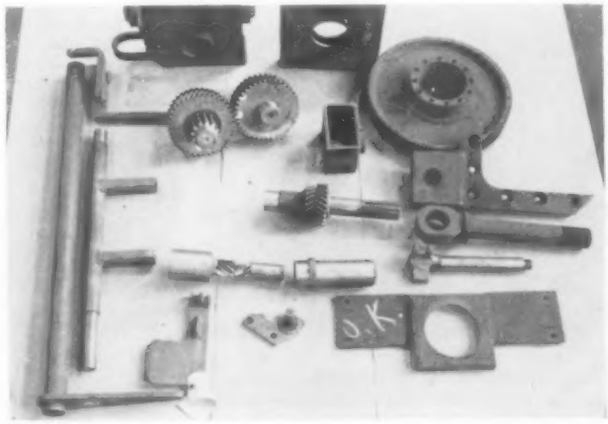


FIG. 18. These parts are examples of machined weldments, some of which are fast-moving or heavy service units.

FIG. 19. A few examples of pre-machined parts that will be welded into fabricated structures and will save machining of the entire structure. Note that they are made from ordinary rolled steel bars, plates, shapes, and tubes.

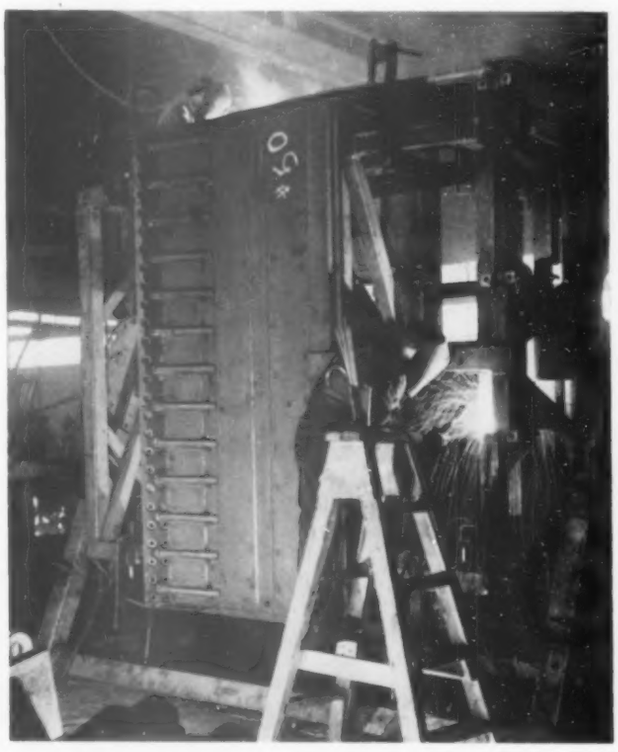
Normalizing Recommended

Caution must be exercised in the machining of heat-affected areas—i.e., areas close to welds or flame cut surfaces. Still another problem is that of locked-up stresses, resulting from the welds. These may create initial distortion, or may cause the parts to shift out of shape because of the locked-up stresses being relieved by the removal of metal during machining.

Fig. 21 illustrates a condition sometimes encountered in the locality of a weld in high-carbon or alloy steels that have not been normalized or stress relieved. If the area is cut into in the process of turning, boring or milling, or the other common machining processes, this condition may cause serious breakage of tools. On ordinary low-carbon structural steel, or steel of the SAE 1010 to 1030 classes, welds and the welded locality are usually machinable without serious difficulty if an ordinary welding electrode has been used.

Even if machining operations are not performed in the immediate vicinity of the welds, it is often a worth-while operation, on high-carbon welded substructures, to normalize them in order to prevent tool breakage that might result from hard spots. These spots may be caused by such a simple

FIG. 20. The relationships between the pre-machined and therefore important functional parts of this large earth-moving scraper body must be maintained accurately and positively. The surfaces of the pre-machined parts, mating accurately with correctly placed stops on the setup fixture, assure proper alignment without machining the whole structure.



thing as a workman accidentally striking or scratching an arc over the surface, and although it may be very small, the resultant scar may cause a hard spot large enough to break a tool or to leave a flaw in the machined surface.

For welded structures upon which there is a large amount of machining, or where close tolerances must be held when producing the units in large numbers, fixtures provide a means of machining without expensive individual layout.

Single and Multiple Fixtures

For units such as gear cases—or even simple plates or structures where holes are to be drilled, reamed, or bored —simple drill jigs, having hardened and ground bushings and stops or other means of locating the part with reference to some special surface, greatly increase the speed with which such parts may be processed.

The fact that welded structures almost always have some flat area or other regular surface that may be used to rest against the stops of a jig or fixture, makes the manufacture of such tools, by the welding method, a relatively easy procedure.

Naturally, the complexity of the unit to be machined determines the type of fixture. For the machining of complex gear cases, it may be necessary to use more than one fixture, whereas in the machining of a simple lug, bolt plate, or bracket, one simple fixture may serve.

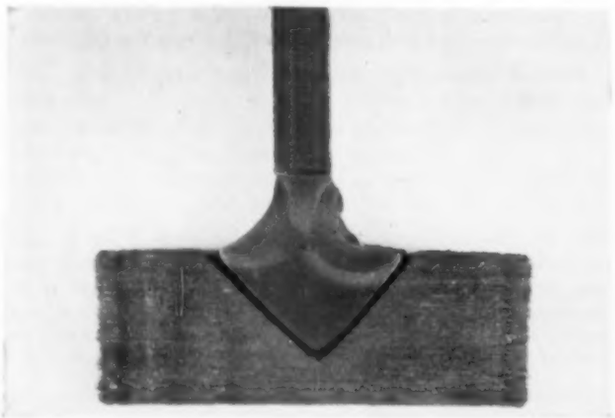


FIG. 21. A section of a welded T-joint that has been removed, polished, and etched to show the heat-affected areas at the margins of the welded areas. These areas (light colored, surrounding dark weld metal) are likely to be hard if the steel is high carbon or alloy and may cause broken tools or irregularities in a machined finish unless they are avoided or removed by normalizing.

FIG. 22. A "roll-over" type special welded fixture for machining a power-control unit frame, gear case, and bolt plate structure. This fixture facilitates machining by reducing setup time, layout, and handling. (Note drill jig with welded stops and hardened bushings at right.)

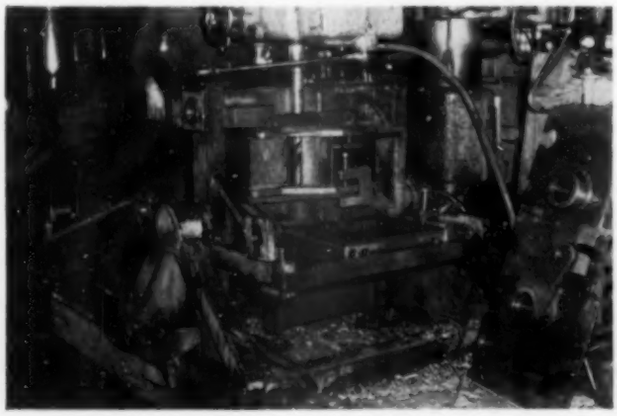


Fig. 22 shows a complex fixture used in machining the main gear case for a cable-operating power-control unit that is mounted on the rear end of a tractor. The fixture is of the "roll-over" type and may be indexed so that a variety of drilling, boring, and counterboring operations may be done on the case with a minimum of handling. The machining of this gear case is done on a radial drill, and a drilling fixture employing hardened bushings and welded-on stops may be observed to the right of the drill column.

A large gear case with a large amount of welding upon it, such as is shown in Fig. 23, should ordinarily be stress relieved or normalized to avoid distortion as a result of the release of stresses when machining, and to avoid hard spots that cause difficulty in machining. This would hold especially in the case of high tensile, alloy steel.

Exceptions to Normalizing

However, it is not always necessary to normalize gear cases and other relatively simple structures that are designed in a box shape and which, therefore, are rigid because of their structural shape and upon which there may be welded bearing blocks that confine their stresses to a relatively well-balanced area. Whether or not gear case or welded structure, requiring machining, should be normalized or not depends largely upon the amount of welds on it, its general shape, the amount of stress to which it will be subjected

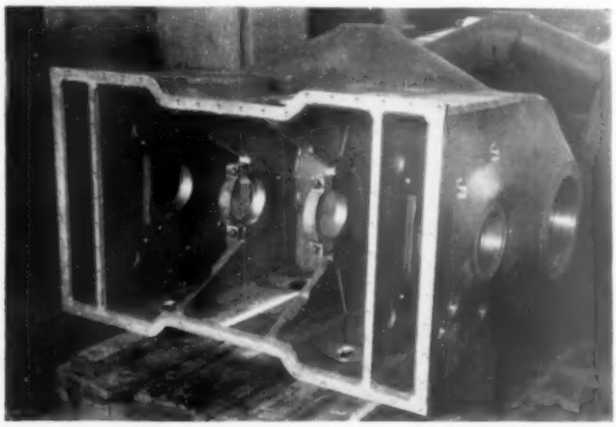


FIG. 23. This 1,700 lb. all-welded gear case is an example of an arc-welded structure that allows close, accurate assembly tolerances to be maintained with a minimum of machining upon the case itself. It is normalized prior to machining.

FIG. 24. When the fuel tank and motor-frame structure are set up and welded to the machined gear case in this fixture (see Fig. 23), the 25 ft. of welding does not seriously stress or distort the case because of its rigid, boxlike design.

in operation, and the heat at which it will operate. If there were great locked-up stresses in a structure that operated at temperatures of 200, 300, or 400 degrees, those stresses would probably be relieved and might cause misalignment of working parts inside the case because of changes in the form of the case itself.

In the example of the large tractor transmission case shown in Fig. 23, it is necessary to normalize the welded case, before machining, because of the close tolerances to which it must be machined, the heat at which it operates, the large amount of welding on it, the curved design of its body and the fact that it is made of alloy steels.

Welding Parts to Machined Structures

After a gear or transmission case—or other relatively complex welded structure—has been machined, it is often possible to weld other structural or premachined parts to it, or to weld it into a more complex structure without causing serious distortion or otherwise hindering the function of the finished structure.

An example of such welding is shown in Fig. 24, where the highly machined main transmission shown in Fig. 23 has been unified, by arc welding, with the combined fuel tanks and motor-hangar frame structure (also of arc-welded construction) to form the complete transmission case, engine hanger, and fuel tank assembly for the tractor.

With its box construction and reinforced cross-member, the welded case makes a sufficiently rigid unit so that welding the major part of the tractor frame to the front side of the case (a process involving approximately 25 ft. of welding on the case itself) still does not draw it appreciably out of shape after a small amount of hand reaming has been done, in the final assembly, prior to the installation of the main bearing cups.

The welding on of lugs, reinforcements, mounting supports, and other accessories that might be arc welded to structures that have been machined, can be done without interference with unit function as long as short intermittent welds are applied and allow to cool, to minimize distortion.

Another method is to design in such a way that the welds required to join the parts to the welded and machined structure balance each other, to equalize stresses, in the same way that flame hardening is frequently applied to both sides of a long narrow section (such as lathe ways) in order to equalize the distorting effect of the heating and to maintain the straightness of the structure.

By John E. Hyler

Metal Shearing Operations

The Tools and Techniques for Shearing Plate, Shapes, Bars and Sheet Metal

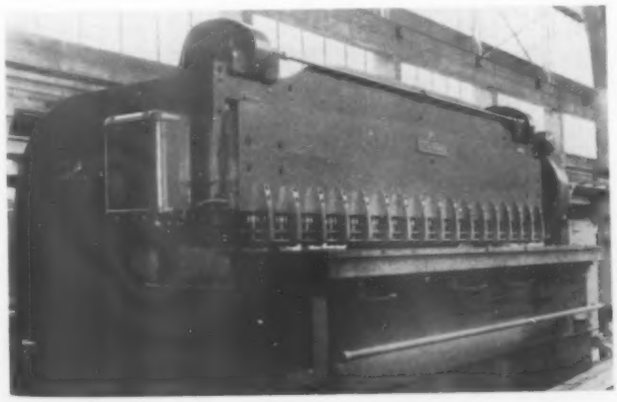
IN ADDITION TO BRINGING improvements of design to standard types of metal shears, recent years have brought new types of shearing units into existence. As a result, a survey of metal shearing operations is now highly interesting, especially as improvements have even been extended into hand-operated metal cutting shears of bench type. Some of these are provided with compound levers, to give a very powerful action on the movable shear blade. Some have capacity for 12-gauge metal, and will make cuts from 3 to 4½" in length. Other hand-operated shears have been developed with curves incorporated in the shear blades, as a result of which they can be used for cutting curved, circular and irregular shapes. These have a ball-bearing type of hold-down for the metal, and are made in different capacities.

Mr. Hyler

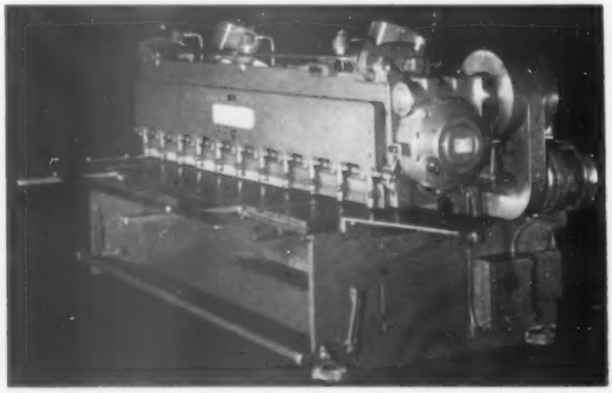
Most bench-type shears for relatively light work have the movable shear blade set in a plane parallel with the one in which the operating lever swings, but this is not true of all. One hand-operated bench unit, having capacity to cut 22-gauge steel to 6 inches in width, has the shear blade mounted on a vertically-traveling gate, at right angles to the direction of lever swing. The operating lever fits into any one of several holes provided in a wheel, on a camshaft at the top of the shear.

In addition to plain shearing, this tool is used for slitting and notching, with the help of gauges on the shear table and the gate. The gate carries an adjustable hold-down for the work, and the shear table is provided with a strip guide. The company making this tool also makes shears

Looking from left hand end of a powerful squaring shears (shown mounted for shipping) which will accurately cut 1¼" heavy plate up to 8 feet in length, and 16-foot lengths of ½" plate. Photos by courtesy of Cincinnati Shaper Co., Cincinnati, Ohio.



Highly competent squaring shear equipped with independent hydraulic hold-downs. A special light beam shearing gauge can be seen mounted directly behind the hold-downs, which makes it easy to shear accurately to lines previously scribed across the stock.



that form one unit of a shear-bender-brake combination, used largely for duplicating small lots of sheet metal parts, without dies.

Portable shears are sometimes of hand-operated type, but recent years have seen the development of a number of electrically-powered portable units. Some hand-operated portable units have the general appearance of tin snips, except that they are much more powerfully made and are fitted with a compound lever system. One line of such shears, made of special alloy, includes some models that have top capacity for cutting 11-gauge strip or sheet, while others will cut up to ¼" steel plate. Special blades are used on these particular tools when it is desired to shear stainless steel.

Portable Electric Shears

With regard to portable electric shearing tools, at least three different types have been observed on sheet metal work in various places. All of these give a very good account of themselves, especially in cases where small-radius curves are to be sheared, along with straight cuts and irregular outlines in general. One of these tools has capacity for cutting at the rate of 78 inches per minute on 14-gauge sheet steel, or on 16-gauge stainless.

Another tool of this general style is driven by an integral electric motor, that operates through a special transmission to reciprocate a shearing cutter against an anvil, at speeds varying from 1500 to 2500 strokes per minute, depending on the load being imposed on the tool. There are two sizes of these particular tools, one having capacity for 18-gauge steel, and the other for 16-gauge. Either tool will cut to radii as small as ¾" in sheet metal. Certain other portable electric sheet metal shears will cut up to 15 feet per minute, and are available in capacities up to 12-gauge hot-rolled steel. Similar but stationary models are used in some places, with capacities up to 10-gauge. There are no less than five such stationary models.

There are also other high-speed stationary shears at work, in various places, that have been especially designed and built to take care of intricate cutting. One of these takes care of a large array of ring and circle shearing work, as well as all other intricate shapes coming to hand, and has sufficient capacity for cutting all kinds of metal up to 10-gauge. Formed pieces can be handled in many cases, as well as flat ones, and consequently this particular type of machine has made a sizable place for itself in industry.

A vast difference is found between the shears mentioned above and the various types found in use in steel mills, including bloom, slab, billet and plate shears. Heavy slabs are sheared to length, some of which are 16 to 20 inches in thickness, and four feet or more in width. This, you will agree, is a heavy bite of metal for any machine to take.

A battery of ultra-modern squaring shears at work. These machines have facilities for cutting with great accuracy, incorporating gauges that allow of setting for dimensions in increments of 1/64".

The cutting of heavy armor plate in huge quantities, as recently required, called for development of high-capacity plate shears. In some cases armor plate up to 2 full inches in thickness is sheared, in pieces ten and twelve feet in width.

Shears for such heavy work are always made in closed-frame or guillotine design, to provide tension members on both sides, to receive the heavy thrust of the cut. Some differences in design are found in heavy shears made by different manufacturers, and there is a large number of makers. Some shears have been observed which cut hot billets from bars, progressively, until the bar has been completely reduced. The hot billet capacity of the units especially in mind is 4½" square. There is a power-driven run-out table, working in conjunction with an ingenious stop mechanism, which greatly speeds the shearing process.

In handling plate and sheet stock to shears in large quantities, some plants have lightened the labor exceedingly by arranging special hydraulic lifts in front and back of the shears. Using such a lift with a sizable number of plates or sheets on it, it can readily be kept at exactly the proper height to feed each succeeding sheet into the machine on a level, without any manual lifting, and consequent excess fatigue. Some manufacturers of such lifts have long been adapting them for this purpose. Whether the stock is heavy plate or light sheet stock, such a lift works to decided advantage.

Good Grinding Essential

Straight blades for heavy shearing may naturally be considered of the very highest importance. The material going into the manufacture of these blades must be correct. Much study has been given this phase of shearing operations. Some leading tool steel manufacturers have steels which they particularly recommend for this purpose. Extensive tests have been made to determine what the analysis of sheer blade steel should be for different types of duty.

Proper analyses differ considerably for light, medium and heavy shearing, as well as for cold and hot shearing. Some of the high-carbon, high-chromium steels have been found exceptionally good for certain types of shearing duty. However, shear blades are available from different reputable sources, and firms supplying them can usually furnish just what is needed. Squaring shears are very often found fitted with laid-steel knives, for these have proven more economical on this type of duty.

It is important to keep the shearing edges of blades in good condition. In order to do so, the use of a grinding machine suited to this particular job is imperative. Many modern grinders used for this purpose often employ a cup,

Steel warehouses require good squaring shears in order to deliver properly sized stock to order. The battery of shears shown here cuts tons of steel per hour, and does it every hour if necessary.

ring, or segmental grinding wheel, mounted on a traveling wheel carriage. The knife bar is so arranged that it can be readily set to any desired angle before the wheel, so a shear blade may be readily ground at any desired angle. The edge of a shear blade is usually ground perfectly square for cutting steel.

For shearing softer materials, a slight departure from square is often indicated, so the angle of the cutting edge will be somewhat less than 90 degrees. It is seldom made less than 80 degrees, however. The theory of shearing is more that of fracturing the material, by highly concentrated and closely localized stress, than that of actual cutting. In shearing flat stock, good practice contemplates making the shear or fracture of the material progressive, beginning at one edge, and progressing to the other. The lower or stationary shear blade has its edge horizontal, but the cutting edge of the upper and movable blade is inclined, to obtain the shearing cut. Different shear operators have different standards for top shear blade rake. Many hold to about 3 to 4 degrees departure from horizontal. In any case, a really good shear blade grinder is very important.

Squaring shears are highly important. Press stamping and forming operations are very strongly affected by accuracy in shearing, or the lack of it, for a large proportion of press work performed follows a shearing operation. In this connection, the angle at which the top shear blade is set has much to do with accuracy obtained, and particularly with desired straightness in the sheared stock.

Having pointed out that good practice requires making a shear cut progressively, we go on to consider that the less pronounced the angle on the top blade edge, the less the stock will be distorted in cutting. This means, then, that great stamina must be built into a squaring shear, so the greater amount of power necessary to the making of a shear cut with a low knife angle, may be applied without harmful deflection of the shear. Another thing that has a pronounced effect on keeping the material straight is having the clearance between the shearing blade edges correct. Some of the more modern squaring shears have the best of facilities for adjusting the shear blades in this respect.

Gages Insure Accuracy

There are many different models of squaring shears in use. Those which are most modern incorporate facilities for closer cutting accuracy than would have been thought possible some years ago. This is done by incorporating gauges with micrometer setting arrangements. One line of squaring shears in mind is provided with a ball bearing back gauge, set by means of a hand-wheel fitted with a micrometer dial. The dial can be provided for setting in increments of 1/64″ or 1/128″, as desired. These shears are made in capacities from 12-gauge metal to 1¼″ plate. Another line of squaring shears in mind, which has been much used in cutting metal for transport planes and big bombers, is made in a complete line of sizes up to 20-foot cutting lengths.

A series of independent hydraulic hold-downs is used on some of the more modern squaring shears. When these are used, alternate light and heavy sheets can be properly clamped without any hold-down adjustment. Also, shorter stock of different thickness can be cut at the two ends of the blade at the same time, and the individual hold-downs will clamp both perfectly, so that no slippage occurs on either while shearing. Incidentally, the machines incorporating these hold-downs may also be fitted with a light-beam shearing gauge, as it is called. This is convenient when shearing sheets to previously-scribed lines on the stock. One simply sets the scribed line in agreement with a sharp shadow that is produced by the gauge, before tripping the shear treadle.

Shears for angle iron are quite often encountered, and are made by many different manufacturers. Angle iron is a material that lends itself for notching and bending for square-cornered structural work, and some relatively light shearing combination units have been observed, that will shear, notch and bend a 2″ x 2″ x ¼″ angle iron, doing the job in one minute. Possibly larger units of this general type are also available. A great amount of variety shearing, and especially shearing of scrap, is performed with alligator shears, which are found operating in varying sizes. Alligator shears are often found having capacities varying from 1″ to 4½″ round or square.

Trend to Rotary Shears

There has been increasing use of rotary shears of recent years. This is probably due in large part to the fact that so many more welded structures are in evidence, and the rotary shear offers a splendid means of shearing circles from sheets and plates, for use in such structures. Some of these shears are of so-called throatless type. One company provides throatless shears in both hand-operated and power-operated models, the hand-operated machines being powered by a hand crank. Capacities are available from 18-gauge metal to ½″ sheet. These machines will cut practically any shape from any size of sheet.

Most rotary shears are made with an open or C-type frame, providing a throat deep enough to accommodate the largest work a given shop will wish to shear. In addition to being made in different throat capacities, they are found in different capacities as to the thickness of metal they will shear. One company has a line of rotary shears that will handle light-gauge metals, and from there up to material 5/32″ thick. Another firm has a line of rotary shears in various capacities from light plate up to 1″ mild steel. This company has developed some very interesting attachments for their rotary shears. One of these is a circle-cutting attachment.

These circle-cutting attachments are made in two ways. One accommodates workpieces which are to have the circular cut made concentric with a hole drilled through the work. In this case, the work is supported by means of a pin through the drilled hole. The other one clamps the workpiece between two ball bearing heads, so it can be swung about a center without drilling any hole.

Another outstanding provision for these rotary shears is used for flanging previously-sheared work. If the work being flanged is circular, the circle-cutting attachment is used in connection with a special assembly of hold-down fingers, using a pair of tool-steel flanging rollers. The flanging rollers replace the rotary cutters used in shearing. For flanging work other than circular, the circle-cutting attachment is not used, but an indicating device is used in its place. Using such flanging equipment, steel sheet from 12-gauge to ⅝″ in thickness can be flanged. A maximum flange depth of 1⅛″ can be obtained on the thinnest sheets, and a maximum of 2¾″ flange depth on the thickest.

We are well aware that various types of special shears found in some of the steel mills and other specific locations, including special bar shears, cropping shears, rocking shears and flying shears, have not been particularly considered in this article. It is not possible to do justice to all phases of the subject of shearing in a single article of this kind. It is hoped, however, that what has been said will be interesting, and will provide a fuller understanding of the subject to some, whose contact with this phase of metal-working may have been limited to a single type of shears, or possibly to some of the older and less efficient machines.

By W. C. E. Prins and Del T. McWilliams

Principles of Job Measurement

Scientific Job Evaluation Promotes Effective Use of Human Abilities

SIZING UP JOBS of work is an old custom—anyone tackling a task, almost automatically arrives at some estimate of what it amounts to. How well the job gets done, however, depends upon how well it is understood and upon what kind of tools and human ability are then applied to it. With modern, complex jobs, it is more necessary than ever that more accurate facts be used in figuring out what they require in the way of equipment and human ability.

Tool Engineers use their expert, highly developed abilities to provide adequate tooling. However, the science of applying human abilities to task accomplishment is far more complex and much less understood. Yet "the last word in tooling" is almost wholly dependent upon the use given it by the personnel.

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The scientific approach of the Tool Engineer is an excellent guide in figuring the human abilities necessary. The *first step* is to describe the job in terms of what people must do, as the Tool Engineer describes or specifies the purpose of his tooling.

The *second step* is to determine the range, or how much of several characteristics is required. A practical list of characteristics to consider, which has been successfully used, is:

1. HUMAN RELATIONS—getting along with people
2. ANALYTICAL ABILITY—figuring out what to do
3. FORCE—going ahead despite difficulties
4. ADAPTABILITY—Coping with new conditions
5. RESPONSIBILITY—being reliable and dependable
6. THOROUGHNESS—finishing a task completely—and no more
7. PHYSICAL CONDITION—being able to do the work
8. KNOWLEDGE—"knowing how"
9. EDUCATION—"knowing why"
10. TRAINING—"showing how" by doing

These characteristics have been found to furnish a satisfactory, complete and comprehensive analysis of *all* types of jobs. On a relatively few jobs, an eleventh characteristic has been found necessary—"Value Due to Unusual Factor," which includes abnormal working conditions or the "following" required on some saleswork.

As JOB MEASUREMENT is used in setting up a task force—or organization of people—to get a job done and as it is also then used in arriving at an equitable wage structure, it should be clear that only one set of standards can be used. Each position in the organization is made up of the same ten (or eleven) characteristics, varying from one another only in how much of each is needed. There can be no "double standards" for workers and supervision.

With a clear job description, specifications for the individual job-positions are then prepared. It is not too difficult to use a scale on each of the characteristics to see how much is needed for a position. The TABLE OF CHARACTERISTICS, appended, is scaled in a manner which has been found practicable.

Most people, with a little practice, can read and agree with one another on the thousandth of an inch scale of a micrometer caliper. But there may be some disagreement about the vernier readings when measuring in tenths of a thousand of an inch. Similarly, it does not take much more practice to read and agree fairly closely on the rating scale of the TABLE OF CHARACTERISTICS. It is just a matter of seeing "how high and how low" applies on the scale to a particular position. At first, the range from high to low will be quite large—as it is in learning to use "mikes." Practice and training will narrow the range until reasonable accuracies and substantial agreement are reached.

Del T. McWilliams **is President of the Detroit Time Study School and senior partner of the Company of Industrial Consultants, Chicago. He is co-author of the book "Production Standards from Time Study Analysis," which is used as a text and reference book by several colleges here and abroad.**

Study of jobs and of the several positions that go to make up an organization shows how characteristics are combined in the individual positions. When work is not properly functionalized, so that individual people do work requiring a blended combination of characteristics, altogether too much is expected of a person. Tool Engineers recognize this principle in working alloys.

Observation and analysis of a large number of jobs and people have shown that there is a natural grouping into three very clear major classes. There are (1) *Technical** positions and people who do the direct work—running machines, fitting and finishing parts, writing the specifications and drafting the drawings and so on. (2) *Administrative** positions and people use formulas, procedures and rules, and see that they are followed and established routines maintained. The keeping of financial accounts, control data and the like are usually considered administrative functions—clerical work, as well as supervision.

(3) *Executive** positions and people are necessary to

**Frequently referred to hereafter as "T," "A" and "E."*

work up the various basic formulas and formulate policy, making sure that they are administered and used as intended. Such work involves getting down to bedrock facts and evolving the formulas from fundamentals. Getting proper use of them is the hardest part of these duties—the most important executive function is really teaching. (Engineering is usually thought of as essentially technical, but there is a recognized need for executives with grounding in engineering principles—for much "engineering" can be reduced to administrative routines.)

Square Pegs and Round Holes

It is very rare to find individuals who have usable ability in any class other than that to which they are naturally fitted by temperament. It is a common experience to see excellent technical workers fail as executives or administrators. Purely technical work on the part of executives is usually solely a hobby at which they could not make as good a living. Very few top-notch presidents of a company or toolmakers could carry on for long as file clerks. People are just naturally Executives, Administrators or Technical workers and their abilities can only be used in the class that comes natural. Positions cannot require a mixture of these abilities if the work is to be done readily and effectively.

Further analysis of job-positions also reveals additional possibilities for properly functionalizing work. People setting up machines, tending them, doing benchwork and the like should not have to stop to figure. The draftsmen, also doing technical work, should be better qualified by training and experience to do the figuring. In such specializing, the same man may be about equally adaptable to both. One position is not, necessarily, better than the other. It is largely a matter of developing ability along one line or the other, *within* the natural class—in this case, Technical.

High grade abilities, of which there will always be too few, are wasted when top-grade workmen, or executives or administrators are required to do many lesser functions, which could be done as well by less capable people. Teams made up of varying grades of positions are always valuable as long as the lower grade workers are not required to spend too much time merely watching and waiting.

The need: (1) for drilling in good work habits; (2) for training and gaining knowledge in the "how" of task performance; and (3) for education in the "why," becomes apparent in studying jobs and positions. Most habits formed "naturally," or by watching others, are found to be wearing on the nerves and unnecessarily consuming of energy because they are seldom right. "Training" by mere exposure to a job invariably introduces many wrong methods. These facts have been recognized in athletics for some time where coaches and trainers are customarily employed. Yet the average job-position is carried on over more hours than most sports and frequently should have far more developed skill.

Change Breaks Monotony

Without education in the "why" of certain habits and methods, any job becomes humdrum and boring. The functionalization of jobs tends to make the positions uninteresting unless there is also education in "what it is all about." In fact, if no education is provided, it is much better not to functionalize jobs at all, but to leave them a mass of many different functions. People do get some relief from changing from one boring thing to another.

In addition to the great amount of teaching by executives, highly functionalized jobs require a correspondingly high degree of co-ordination of the several positions. When the jobs are routine, repetitive types, they can be readily co-ordinated by administration with well established procedures. But, when the jobs are not of a routine nature, the amount of co-ordination necessary becomes a very difficult executive task.

It is easy to see why supervision leaves so many job-positions complicated, thereby requiring rare combinations of characteristics. However, such positions are then seldom filled adequately and the job is done poorly or inefficiently.

It is not so easy to see why there is not more drilling, training and education in industry when the modern proficiency attained in athletics by coaching is so well known. Of course, it appears simpler to hire a supposedly "trained" man than to train him.

Getting back to the procedures for JOB MEASUREMENT, the proven technique is to have the person filling a position describe it as he thinks it is. Where more than one person has the same position, an acceptable representative should describe it for all of them. The immediate supervisor should independently describe the position as he sees it. Then a competent engineer should reconcile any disagreement and make sure himself that the description is really a true specification of the purpose of the position and what has to be done to accomplish it.

How to Use Rating Scale

At this stage, recommendations for functionalization and training are usually made by the engineer. The job-position specifications will show how difficult it may be to fill it. Some "labor unrest" arises from trying to fill unduly complicated positions with people who are bound to feel that they are misfits. Without cold analysis such as this, it is difficult to "put your finger" on the trouble.

When a position description, satisfactory to all concerned, has been drawn up and approved, the next step is to use the rating scale of the TABLE OF CHARACTERISTICS. The representative of those filling the position, the immediate supervisor and the engineer should each, independently, use the rating scale on each of the 11 characteristics in the TABLE OF CHARACTERISTICS. Where there is a shop committee, a representative—preferably trained in this work—should also rate the position along with a management representative.

Agreement should be reached at least within ten figures on the rating scale for each of the 11 characteristics in the table. Absolute agreement, however, is rarely reached and a *weighted average* gives the best, most accurately usable consensus, as follows:

	Weights Recommended (multiply x)
Position holder or representative; foreman	1 each
Shop representative and/or personnel representative	2 each
Management Engineer (preferably an independent consultant)	4 each

The only difficulty encountered in obtaining agreement on position rating lies in unduly considering the qualities of the person who is already holding the position. Because someone with a college degree is doing the work is no reason for assuming that a degree is required. On the other hand, analysis may show that a "full blown machinist" is needed on certain drill press operations instead of just an operator.

While the foregoing discussion makes the undertaking of JOB MEASUREMENT seem somewhat complicated, there is no gainsaying that it is important enough to warrant pains. Actually, competent engineers, well versed in the techniques, can get the measurements made, correctly, with less fuss and bother than is customary with apparently quicker and simpler methods.

With a measurement made and approved, it is easier to fit people to the well defined position. Everyone knows what is expected. Training is clear-cut.

How well people carry out the work assigned them can only be determined by comparison with *standards* of what a thoroughly competent, trained person can do in a certain time, under good working conditions. This is a matter of work performance study, a subject beyond the scope of this discussion.

The *value* of a position can be set as the sum of the scaled ratings for all of its characteristics. Experience over some twenty years has shown that such a "value" is worth little. Data can and have been built up in table form to give the relative *values* of the different rating scales as determined by extensive experience.

"Up-to-Dateness" Essential

After some six years of work with such *values*, it was found that they were not wholly adequate gages. The combination of characteristics must also be fully considered. Multiplying factors can and have been prepared which produce a final answer in *points*. One such system has not needed modification for over four years. It has so far developed no "bugs." It works.

With *points* determined for positions, the only basis for argument is how much a *point* is worth in dollars. Design of wage structure is a subject also beyond the scope of this article, although it may be seen that *points* are its most valuable material.

In conclusion, it should be remembered that jobs and the positions that go to make them up may change, with no one noticing the succession of small additions or refinements which creep in, making them tougher—or the equally small simplifications. Everyone concerned should have copies of the job-position specifications before them. When the changes are permanent and important, new specifications should be drawn up.

Not only must the individual positions continue to be realistically specified, but the overall design of wage structure must remain sound. Superficial JOB MEASUREMENT, improperly supervised, leads to a weakening of the wage structure, rendering it liable to collapse. The common tendency observed has been to "de-skill" positions in crude and uninformed functionalization. Fortunately, properly set-up task forces—organizations of people to get jobs done—invariably consist of the proportion of people at the different position levels which makes for sound wage structure.

TABLE OF CHARACTERISTICS

No. 1 Human Relations

Rating Scale

00 Cannot work with others without continual friction.

10 Affable; can do own job as part of a group.

20 Actively friendly; does not cause friction within a group, directly or indirectly. Appearance and actions agreeable.

30 Co-operative; solicit and extend assistance; try to reduce friction. E (Executive), A (Administrative)—Drill individuals in the functions of their tasks.

40 E, A—Train individuals in whole tasks; co-ordinate individual efforts within a group to attain a common end.
E—Enlist active individual support for a program.

50 E—Educate individuals in task purpose and reasons for methods used in accomplishment; see and use individual abilities; obtain active group following by arousing and maintaining interest.

60 E—Lead department of several groups through group leaders, maintaining the organization along functional lines and co-ordinating the efforts of the groups.

70 E—Develop team-work between the groups within a department so that the main effort is to accomplish the whole task rather than just the portions assigned each group.

80 E—Lead a division or complete organization of several functionally different departments by co-ordination to a common end.

90 E—Obtain active support and following of a complex organization through divisional and subordinate leaders.

The rating scale is progressive for this characteristic. To be able to perform at any point on the scale requires ability in all of those lower on the scale, within the general, or Executive, Administrative categories.

No. 2 Analytical Ability

00 Cannot follow verbal instructions.

10 Understand and follow simple verbal instruction.

20 Understand and follow written instructions and diagrams.

30 Obtain necessary facts to govern actions and apply formulas or "rules of thumb."

40 Readjust facts to new conditions, not governed by "rule of thumb."

50 Draw logical analogies for course of action, based upon experience and knowledge but not "rule of thumb" or formula.

60 Weigh facts for balanced correlation.

70 Draw conclusions from array of facts after weighing and correlating.

80 Synthesize analyses with due regard to: (a) Major and minor premises, (b) Probable accuracies of facts.

90 Abstract thinking beyond known, measurable facts.

This characteristic of "analytic ability" is *not* progressive. In general, those persons capable of abstract thinking, for instance, are not adept in the use of formulas or "rules of thumb."

No. 3 Force

00 Cannot carry out a direct order without deviation.

10 Carry out immediate orders for a functionally understood duty without turning from the path outlined.

20 Carry out a train or sequence of orders for a task of several functional duties without deviation.

30 Carry out instructions for a task without "side-tracking" into alternative paths of action.

40 Follow task instruction regardless of apparently easier courses.
E, A—Transmit orders and see that they are followed regardless of alternatives or interferences.

50 Follow general patterns of training when deviations appear easier.
E, A—Drill individuals in functional duties for compliance with orders.

60 Follow policy established without deviation (implies education or indoctrination in whole tasks).
E—Train individuals in the techniques of tasks; initiate pertinent orders for consummation without deviation.

70 Carry out accepted policy principles when other policies may be superficially more attractive.
E—Develop teamwork despite "grandstanding" tendencies on the team.

80 Accomplish policy mission in the face of material and time consuming difficulties.
E—Indoctrinate or educate others in policy principles so that they are accepted and applied.

90 Accomplish policy in opposition to conflicting courses of others.

The above characteristic is progressive within the general and E, A categories; each ability on the scale requires ability on the lower levels.

No. 4 Adaptability

00 Cannot change from previously established patterns of action without continual direction.
10 Change patterns of action with only occasional and predictable relapses requiring further orders or direction.
20 Change upon direction without returning to previous patterns.
30 Change to indicated new course of action without detailed direction.
40 Change to new course of action of own volition.
50 Change of own accord to several successive courses of action as circumstances are altered.
60 When clearly necessary, immediately start anew on completely different set of patterns.

This characteristic is wholly progressive.

No. 5 Responsibility

00 Irresponsible; cannot be trusted with simple tasks and minor values.
10 Responsible as directed by distinct orders or instruction.
20 Accept responsibility for own actions (within abilities otherwise classified); trustworthy; dependably follow an established pattern.
30 Decide own responsible actions and can be relied upon to select the appropriate, established pattern of action.
40 Socially conscious—responsible for own actions within a group, appreciating their interrelationship with group actions.
50 Responsible for the actions of other individuals in a group.
60 Responsible for the actions of a department of several groups.
70 Responsible for the actions of a division of several departments.
80 Responsible for the actions of several divisions.
90 Responsible for the actions of several associated organizations.

This characteristic is wholly progressive. Ability at any point on the scale requires ability at all of the lower levels.

No. 6 Thoroughness

00 Cannot close a task definitely—overdo or underdo it if allowed any leeway.
10 Conclude one well defined, functional, duty as specified.
20 Conclude one fully defined task composed of several functions.
T (Technical)—Plan duty for helper in complete detail and see that he does it.
30 Conclude two or more definite, related, tasks.
E, A—Plan functional duties for several others and see that they are carried out.
40 Conclude one partly defined task by obtaining specifications.
E, A—Plan and follow-up the performance of several tasks made up of related duties.
50 Conclude concurrently several partially defined tasks by obtaining specifications.
E, A—Plan and follow-up the performance of several tasks by obtaining the relevant facts and completing the specifications.
60 Conclude concurrently two or more definite but functionally unrelated tasks.
E, A—Plan and follow-up the performance of functionally unrelated tasks.
70 Conclude two or more partially defined and unrelated tasks concurrently, obtaining specifications and taking proper precedence.
E, A—Plan and follow-up the performance of several partially defined and functionally unrelated tasks by supplying specifications and scheduling the proper sequence.
80 Make provision for contingencies.

This characteristic is progressive within the general and E, A, T classifications.

No. 7 Physical Condition

00 Cannot work 8 hours per day, seated; lifting not over 5 lbs. repeatedly, 50 lbs. intermittently.
10 Perform "light tasks," seated; lifting not over 5 lbs. repeatedly, 50 lbs. intermittently.
A—Carry on clerical work with powered equipment, pens, pencils, etc.
20 Perform "light" tasks as shown, on feet 8 hours per day.
A—Operate manual clerical equipment.
30 Lift 5-25 lbs. repeatedly, 50-100 lbs. intermittently, or
Deft, rapid grasping and positioning of objects by hand alone (wrist rested).
40 Lift 25-50 lbs. weights repeatedly, 50-100 lbs. intermittently, or
Fitting objects by manipulation, or
Co-ordination of multi-patterned (reflex) operations such as typing or piano playing.
50 Lift 50 lbs. repeatedly; over 100 lbs. intermittently, or
Precise co-ordination of hand (wrist rested) with eye, ear or hand.
60 E, A—Stamina for the strain of No. 1-50*, or No. 1-30 plus No. 2-50, or No. 1-30 plus No. 3-40.
T—Co-ordination of hand and eye with body, other individuals or machines.
70 E, A—Stamina for the strain of No. 1-50, or No. 1-40 plus No. 2-60, or No. 1-40 plus No. 3-50.
T—Co-ordination of hand (wrist rested) and eye to less than .05 minute action.
75 E, A—Stamina for the strain of No. 1-60, No. 2-65, No. 3-60, or two or more of No. 1-50, No. 2-60, No. 3-50.
80 E, A—Stamina for the strain of No. 1-70, No. 2-70, No. 3-70, or two or more of No. 1-60, No. 2-65, No. 3-60.
T—Co-ordination of hand and eye to body, other individuals or machines with less than .05 minute action.
85 E, A—Stamina for the strain of No. 1-80, No. 2-80, No. 3-80, or two or more of No. 1-70, No. 2-70, No. 3-70.
90 E, A—Stamina for the strain of No. 1-90, No. 2-90, No. 3-90, or two or more of No. 1-80, No. 2-80, No. 3-80.
T—Physical co-ordination of less than .02 minute action.

This characteristic is progressive within the general and E, A, T classifications.

No. 8 Knowledge

00 None.
10 Know how to manipulate or operate one type of equipment or system on single operations, or
Know 100 stock or filing items.
20 Know how to manipulate or operate several similar or associated pieces of equipment or systems on several operations, or
Know 1,000 stock or filing items.
30 Know how to set-up one item of equipment or single system, or
Know 10,000 or more stock or filing items.
40 Know how to set-up several associated sets of equipment or systems.

**This means item "No. 1"—Human Relations; with "50," of course, referring to the particular rating on the rating scale.*

The Editors

50 Know the methods for all related, functional, tasks.

60 E, A—Know the basic, theoretical principles of a whole field of activity.
T—Know the methods for several associated, but not functionally related, tasks.

70 E, A—Know the broad, not directly related, theoretical principles of several associated or overlapping fields of activity.
T—Know the methods for a whole field of activity.

80 E, A—Know the basic principles and practical, up-to-date details in an entire field of activity.

90 E, A—Know the basic principles and practical, up-to-date details in several associated or overlapping fields of activity.

This characteristic is progressive within the general and E, A, T classifications.

No. 9 Education

00 None.

10 2nd Grade or equivalent proficiency in reading and writing.

20 4th Grade or equivalent proficiency in arithmetic.

30 8th Grade or equivalent proficiency in the use of formulas.

40 10th Grade or equivalent proficiency in reading and writing and pre-trade backgrounds—similar to a novice in a trade.

50 12th Grade or equivalent proficiency in theory (the "why") and practice of a trade, craft, clerical work or academic fundamentals—including ability to read, write and understand the pertinent "literature"—similar to an apprentice.

60 14th Grade or equivalent proficiency in the advanced techniques of a particular specialty—similar to a journeyman.

70 16th Grade or equivalent proficiency in all related theory and techniques of a particular specialty or field of activity—similar to a bachelor's degree or master of trade.

80 Proficiency in associated theory and fundamentals of a field of activity with special, outstanding grasp of a particular activity—similar to a master's degree.

90 Proficiency in theory and fundamentals of a caliber to be rated as an expert in one or more phases of a field of activity—similar to a doctor's degree.

This characteristic is progressive throughout.

It should be noted that a distinction is made between: (1) facts and patterns of action *known* under characteristic "No. 8—Knowledge"; (2) *proficiency* at or *mastery* of specific lines of action, involving reasons, under "No. 9—Education" and (3) the *habits* formed under "No. 10—Training."

People can be *drilled* or coached to form certain functional patterns of action or pick up "how to do" habits from doing, and they can also be *trained* to do several associated things which may not be directly related functionally all under the heading "No. 10—Training." Characteristic "No. 9—Education" arises from *learning* to do the specific things, with or without formal teaching, and determining the "why" of the actions.

No. 10 Training

(This scale is graduated more closely over the range of most frequent application as it may be more accurately determined, being less subject to opinions than the other characteristics.)

Rating Scale		Months of On-Job Experience	Weeks With Formal Training		Plus Education
		A, T		E	
00 A, T—Novice	E—Group Leader	0- 4	0	0- 8	0	0- 4	0
1 in trade or		5- 7	1	9-13	1- 2	5- 9	1
2 craft, ma-		8- 9	2	14-17	3- 4	10-11	2- 3
3 chine feeder,		10	3	18-20	5- 6	12-13	4
4 helper, clerical		11	4	21-22	7	14-15	5
5 routines		12	5	23-24	8- 9	16	6
6		13	6	25-26	10-11	17	7
7		14	7	27-28	12-13	18-19	8
8		15	7½	29-30	14-15	20	9
9		16	8	31	16	21	10-11
10		17	9	32-33	17-19	22	12-13
11		18	10	34-35	20-21	23	14
12		19	11-12	36	22-24	24	15
13		20	13	37-38	25-26	25	16-17
14		21	14	39-41	27-28	26-27	18-19
15		22	15-16	42-45	29-31	28-29	20
16		23-24	17	46-48	32-33	30-31	21-22
17		25-26	18	49-52	34-36	32-34	23-24
18		27-29	19-20	53-57	37-40	35-38	25-26
19		30-33	21-22	58-65	41-43	39-43	27-29
20		34 on	23-24	66 on	44-47	44 on	30-31
21			25		48-50		32-33
22			26-27		51-54		34-36
23			28-29		55-58		37-38
24			30-32		59-63		39-42
25			33-35		64-69		43-46
26			36-38		70-74		47-50
27			39-42		75-84		51-56
28			43-48		85-93		57-62
29			49-54		94-105		63-70
30			55 on		106 on		71 on
10 A, T—Appren-		0- 1		0- 2		0- 1	
11 tice in trade		2		3- 5		2- 3	
12 or craft, oper-		3- 4		6- 8		4- 5	
13 ator, sales or-		5- 6		9-12		6- 8	
14 der taker, non-		7		13-15		9-10	
15 routine		8- 9		16-18		11-12	
16 Clerical		10-11		19-21		13-14	
17 functions		12		22-24		15-16	
18		13-14		25-28		17-18	
19		15-16		29-31		19-20	
20 E—Dept. Head		17	0- 1	32-35	0- 3	21-23	0- 2
21 A, T—Journey-		18-19	2	36-38	4	24-25	3
22 man in trade		20-21	3	39-42	5- 6	26-28	4
23 or craft, sales		22-23	4	43-47	7- 9	29-30	5- 6
24 solicitation,		24-25	5	48-49	10-11	31-32	7
25 Secretary		26-27	6- 7	50-53	12-13	33-36	8- 9
26		28-29	8	54-58	14-15	37-39	10
27		30-32	9	59-66	16-18	40-44	11-12
28		33-36	10-11	67-72	19-22	45-48	13-15
29		37-41	12	73-81	23-24	49-54	16
30		42 on	13-15	82 on	25-29	55 on	17-19
31			16-17		30-33		20-22
32			18-19		34-37		23-24
33			20-22		38-42		25-28
34			23-24		43-48		29-32
35			25-28		49-55		33-36
36			29-31		56-62		37-41
37			32-36		63-71		42-47
38			37-41		72-81		48-54
39			42-50		82-99		55-66
40			51 on		100 on		67 on

40 A—Administrative assistant, accountant, traffic director, sales development and promotion, etc.
T—Engineering technician.

50 E—Division Leader.
A, T—Master of trade or craft or bachelor's degree.

60 E—Leader of division with staff.
A, T—Master's degree or equivalent in specialized training.

70 E—Organization leader—several divisions.
A, T—Doctor's degree or equivalent in specialized training.

80 E—Leader of organization with staff.

90 E—Leader of an organization with more than one related activity.

This characteristic is progressive within the general and E, A, T classifications.

"Months of On-Job Experience," in the above table, implies time spent working at a job with no coaching; "Weeks with Formal Training" implies experience *with* instruction of trade school type; "Weeks Plus Education" implies the additional reasoning of the better apprenticeship courses augmenting trade school instruction.

Like all the other characteristics, "No. 10—Training" is not directly applicable to an individual person. The *average* times required for attaining proficiency in a job determine the value—of the job. The only measure of a person is how well he does the job.

The times shown for "on-job," "formal training" and "plus education" are those for qualified personnel. These times are not always required, to the extent shown, for particularly proficient persons. The complexity of each position must receive full consideration—remembering that experience has shown that most folks found on jobs could be better trained.

No. 11 Value Due to Unusual Factor

1 Extremes of heat and cold.
2 Extremes of dryness or wetness.
3 Hazards not controllable personally.
4 Noises and vibration.
5 Seasonal employment.
6 Drawing power or "following."
7 Showmanship.
8 Market value.

Most of these factors in item 11 are of the type making full time work difficult.

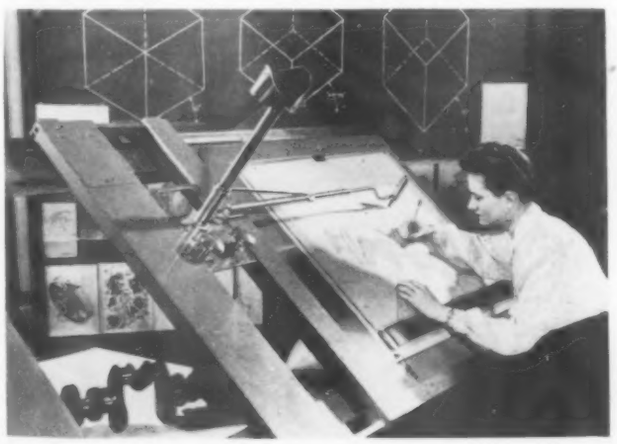
All of the above eleven characteristics in the complete table, designed as they are to give a comprehensive analysis of all types of jobs, have successfully proven their worth in actual practice, over a considerable period of time.

The Editors.

Three Dimensional Drawings with Robot "Rembrandt"

Reduction in mechanical drawing time, through use of a Robot "Rembrandt"—called by the trade name Sun-Vu—is given as one reason why the Studebaker Corp'n, South Bend, Indiana, was able to so effectively finish its 1947 model program. By use of this "robot," complicated designs were executed, in hours, instead of days of work as formerly required by the all-hand method. The machine was used to draw actual objects, as in the illustrated crankshaft example; however, it can be used to convert blueprints to a single three-dimensional, true-to-scale drawing. In the latter practice, a part can be drawn as if viewed from any angle merely by tilting the blueprint to a specified plane and projecting the view.

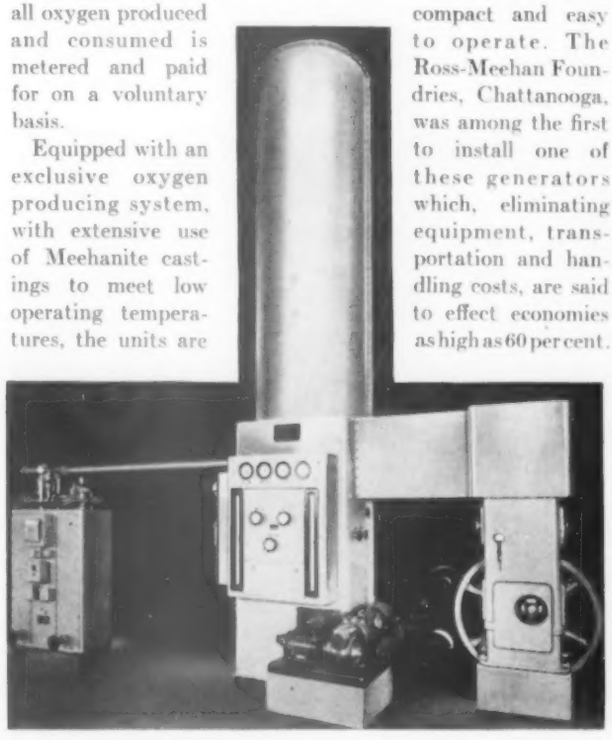
The apparatus consists mechanically of a hooded eye-piece and an electrically-actuated pencil point mounted inside an arm extending from the base of the eye-piece. The sighting instrument can be moved horizontally and vertically above an object which has been placed on the drawing stage as shown at the lower left. As the draftsman sights salient design points through cross hairs in the hooded eye-piece, he presses the control button, when the pencil makes a dot on the drawing board. The drawing is completed by connecting the dots and applying hand shading.



Oxygen Generators on Lease

Air Products, Inc., Chattanooga, Tenn., now offers a new service to industry by providing Oxygen generators on a lease basis. One or more of the various sized generators, illustrated, may be installed at the customer's plant, where all oxygen produced and consumed is metered and paid for on a voluntary basis.

Equipped with an exclusive oxygen producing system, with extensive use of Meehanite castings to meet low operating temperatures, the units are compact and easy to operate. The Ross-Meehan Foundries, Chattanooga, was among the first to install one of these generators which, eliminating equipment, transportation and handling costs, are said to effect economies as high as 60 per cent.



By Thomas A. Dickinson

Report on Plastic Tooling

Progress in Plastics Accelerated by Developments in Tool Engineering

IN RECENT MONTHS, the writer has been privileged to visit more than a hundred plants in which plastic tooling is being utilized for production purposes. A number of these plants were using plastics only because of the continued metals shortage; in most cases, however, it seemed obvious that plastics have found a permanent place in the business of tool fabrication.

Thomas A. Dickinson **is a graduate of Washburn College, Topeka, Kan., and gained practical experience with Consolidated Vultee Aircraft, among others. Author of several books, he specialized in tool and production engineering at San Diego State College and University of Southern California. At present, he is serving as consultant for several West Coast plastics concerns.**

Phenol-formaldehyde casting resins were the most often encountered plastic materials, and inquiries revealed that this is probably due to the following facts:

(1) Such resins are easy to work with, and can be readily fabricated in numerous shapes in a minimum amount of time. (2) They have comparatively low shrinkage properties, and will retain accurately-cast dimensions for long periods of time. (3) They have the sort of strength properties that will give the finished tool a long and useful life.

Typical of the phenolics now in use is a material called Plastitool, produced by Duorite Plastic Industries of Culver City, Calif. It is said to have the greatest impact resistance of any phenolic now on the market, and it can be used to produce finished casts in less than 20 minutes.

Organizations that are making use of Plastitool include Hexco Products Co., Chicago; Douglas Aircraft Co., Los Angeles, and Electronic Products Co., Elizabeth, N. J. The tools being produced range from small lathe and checking fixtures to large drill jigs and stretch dies. Here is a typical fabrication process:

(1) Plastitool is mixed with catalyst in a bakery cake mixer. If high-speed curing is important, a "hot catalyst" may be used. The regular catalyst requires six to eight hours of curing, but produces casts with the highest strength properties. (2) The mixed material is poured into a plaster or similar mold, whose surfaces have been coated with lacquer and wax. (3) Curing is accomplished in an oven at 150° to 200° F. (4) The cured article is removed from the mold as soon as it has had time to cool.

Mold shrinkage thus encountered averages .0025" per in. Although the finished casts weigh only 76 lbs. per cubic foot, they will withstand compressive loads of more than 16,000 p.s.i. and can be machined like wood.

Diallyl phthalate thermosetting plastics derived from petroleum products by Shell Development Co., at Emeryville, Calif., may eventually become close competitors to the phenol-formaldehyde casting resins. These are liquid esters which may be distinguished by their ability to polymerize into hard clear solids—a transition which is so completely controllable that it may be accomplished in minutes

An ordinary drill press may be set up to spin a plastic-filled casting mold. Such spinning eliminates the air bubbles that sometimes make plastic casts porous and weak.

Centrifugal casting, long known to material fabrication, is comparatively new in the plastics field. The men shown are pouring a plastic compound into a mixing vat as a preparatory stage to casting.

or delayed indefinitely. They are not yet as easy to handle as the phenolics, but they should be desirable for many types of tooling because of their strength properties and transparency. At this writing, transparent casting resins which would be suitable for tooling are virtually unknown.

In the manufacture of drill jigs for contoured surfaces, plastic laminates are particularly desirable. These materials are ordinarily more expensive than previously-described casting compounds, but they can be fabricated with such ease and in such complex shapes that their basic costs become relatively unimportant.

Typical of the high-strength laminates now available is Conolon, a material produced by impregnating Fiberglas with Metlbond resins and curing. Its physical properties are approximately as follows:

Maximum modulus of elasticity	4.7×10^6
Maximum tensile strength	120,000 p.s.i.
Maximum compressive strength	56,000 p.s.i.
Specific gravity	1.64
Resistance to acid and alkaline solutions	Good
Resistance to water and oils	Good
Maximum Rockwell hardness (M-scale)	110
Maximum impact resistance	126 ft. lbs./in.^{2}
Ultimate bearing strength	82,000 p.s.i.
Resistance to vibrations	Excellent

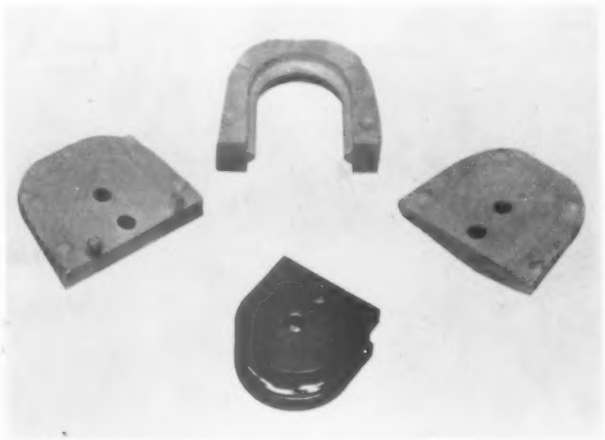
The specific procedure followed in laminating Conolon varies in accordance with the nature of the tools to be fabricated and the stresses to which those tools will be subjected. Generally speaking, the lamination should be such that all of the fabric fibers will be at an angle to one another. The curing may be accomplished either in a vacuum bag or in a hydraulic press at a pressure of 10 to 15 p.s.i. and a temperature of 300° F. (+25° or —10°) in a period of approximately 30 minutes, depending on the thickness desired.

In the fabrication of various forming tools, thermoplastic casting resins have achieved a position of unparalleled importance. Although they do not have great heat resistance or impact strength, these materials are extremely easy to handle and can be salvaged innumerable times by melting.

Typical thermoplastics are ethyl cellulose and cellulose acetate butyrate. They are prepared for casting by melting in a double boiler whose outer container is filled with an oil bath to prevent overheating, and the casting is accomplished simply by pouring over or into a suitable form. For example, extremely cheap and useful drop hammer punches can be made by pouring a molten ethyl cellulose material over a Kirksite die which has been suitably positioned in a wooden frame. Virtually all thermoplastic casting compounds have good compressive strength.

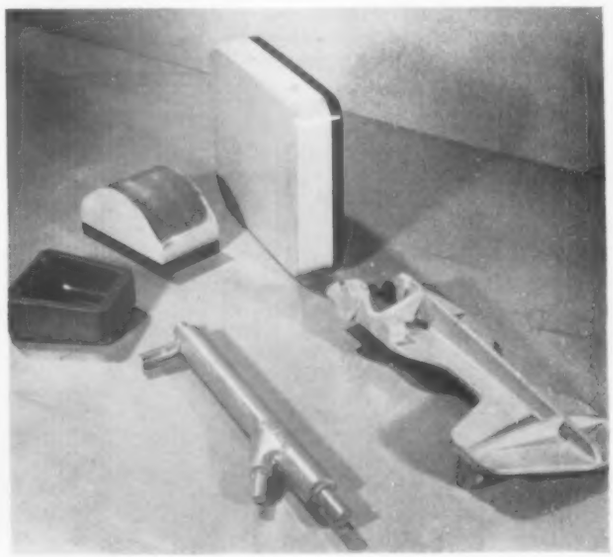
Plastic adhesives, such as Chrysler's Cycleweld, have made it possible to combine the advantages of plastics and metals

The base of this drill jig was made by casting Plastitool. The upper frame was made by molding Conolon and mounting on metal arms.



A Thermoplastic bending block and the three parts of a plaster mold in which it was cast.

Miscellaneous items that have been cast with Plastitool a high-strength phenolic which has the greatest impact resistance of any plastic currently known to exist.



in the manufacture of various tools. For example, a Kansas City manufacturer is currently making good low-cost blanking dies by Cyclewelding sheets of tool steel to the surfaces of light-weight cast-phenolic blocks.

Extruded plastic sections have been used to some extent in building up small assembly jigs or fixtures, but as a rule such tools were satisfactory only when there was no possibility of rough treatment.

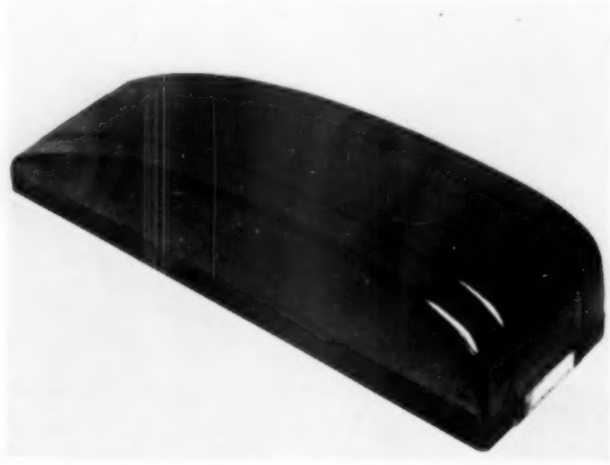
In point of fact, rough handling is probably the greatest problem that can be encountered in utilizing any type of plastic tooling. As one manufacturer puts it, "Good plastic tools will stand up about as well as good metal tools, but no precision instrument can be expected to hold up if it is constantly subjected to stresses for which it was not designed. Our employees have been so thoroughly sold on plastics that they sometimes do not realize this. Therefore, our losses due to carelessness have been greater with plastic tools than with other types of tooling."

The most important considerations in designing a plastic tool are the physical limitations of the material that must be utilized. For this reason, it is frequently necessary to observe precautions such as the following:

(1) Do not call for reentrant curves or undercuts on small diameters. These can sometimes be made on large diameters, but they are invariably expensive. (2) Do not call for thin walls adjacent to thick sections. Unequal shrinkage causes cracks. (3) Do not call for sharp inside corners where fillets are permissible. Sharp corners may cause weak walls. (4) Do not call for long side holes which have no provisions for support. Such holes can be made, but they greatly increase the cost of the plastic tool.

(5) Do not call for components with holes near their edges or faces. The thin sections adjacent to such holes will tend to blister or crack. (6) Do not call for projecting inserts too close to an edge. (7) Do not call for oblique holes. These are extremely difficult to make. (8) Do not call for tolerances closer than +.002 inch on small dimensions or +.005 inch on large dimensions unless they are absolutely necessary. Plastic tools can be fabricated to dimensions that are accurate within a fraction of a thousandth of an inch, but they are inordinately expensive.

(9) Do not call for sharp entering corners on holes that are to be tapped. All tapped holes should be countersunk, so that their edges will not chip when the tap is withdrawn. (10) Do not call for molded holes which are 1/16 inch or less in diameter and more than 2½ times that diameter in length. Such dimensions can cause untold fabrication difficulties. (11) Do not run an outside thread all the way down the face of a boss. Such a thread will necessitate a knife edge on the mold where the thread starts away from the surface, and knife edges are always trouble points because they have a pronounced tendency to break off.



A form block, which was made by casting a thermo-plastic material in a plaster mold. It has great compressive strength.

This photograph indicates the process of making a plaster splash cast. This will be used in making a model and a mold for casting plastics.

Centrifugal Casting

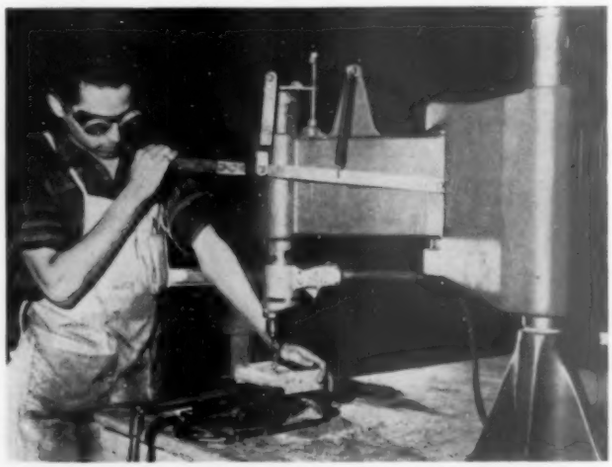
In casting complex shapes with thermosetting materials, the foremost problem is to eliminate air bubbles prior to curing the resin so as to avoid the production of a weak and porous cast. Therefore, considerable attention has been recently concentrated on an old metals fabrication process known as "centrifugal casting."

Experiments at Rezolin Co., Beverly Hills, Calif., have shown that a modified version of centrifugal casting can be used to eradicate the air bubbles that are created when a casting resin is poured into a mold. It consists simply of spinning the mold for one to three minutes before placing the mold in an oven for curing.

This spinning may be accomplished by making a special set-up with an ordinary drill press, as indicated in an accompanying illustration, or with any of several similar set-ups. Its purpose is to create centrifugal forces to dissipate air bubbles.

The plastics used in centrifugal casting may be mixed and handled in an ordinary manner, except for the spinning.

The base and arms of the drill press, shown, were made by casting a phenol-formaldehyde plastic in a plaster mold.



By L. H. Rhodes

Crush Form Thread Grinding—British Method

An Outline of Crush Forming of Grinding Wheels and Current Practices in England

SOME TIME AGO I noticed an article in *The Tool Engineer** in which the Sheffield Corporation of America had introduced a new machine for thread grinding. This machine was of the multiple ribbed wheel type and the truing of the thread was carried out by a crusher which transfers the form on to the grinding wheel.

I was rather surprised that this method was not in general use in the States, as in the United Kingdom it is almost universally used in preference to the single ribbed wheel. There is nothing unusual in this at it appears to be a case of "necessity being the mother of invention," and in Britain it was more or less a necessity.

For years, the merits of the British Standard Whitworth form of thread as against the American V form threads has been discussed. And it would appear, in past years, that the American V form thread was in many instances a much easier thread to produce. Before a change is made, there must be no shadow of doubt that the change is for the best, because Engineers are of one mind on the question that there is never advantage without disadvantage.

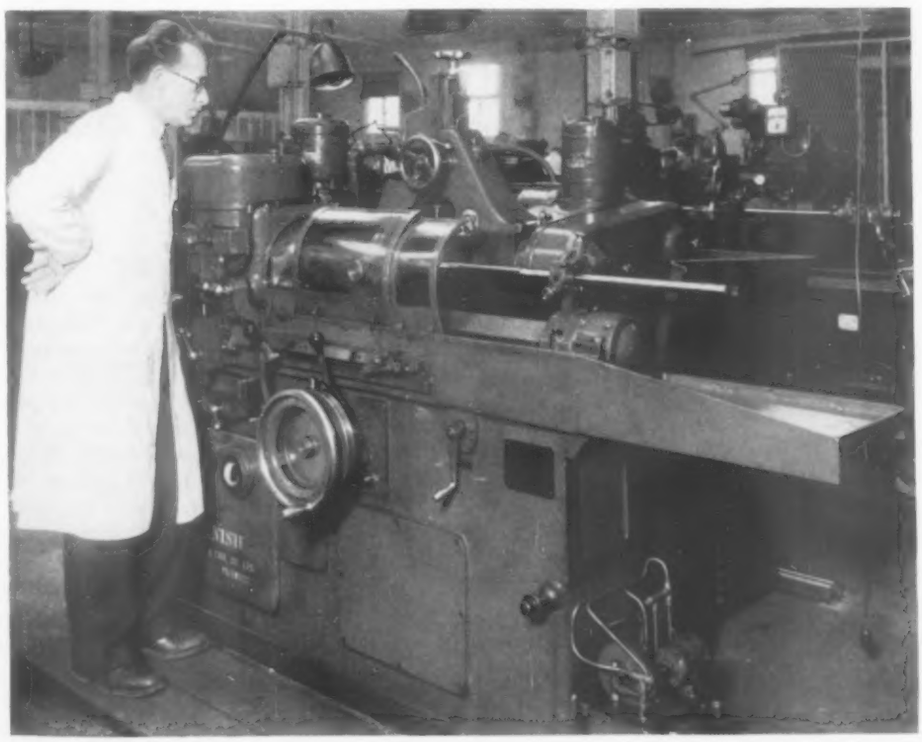
During the War, many new methods of increasing production were explored; particularly with the manufacture of parts required in large quantities, but at the same time the product had to be improved in quality. Cheap production of inferior products was of no avail and was a step backwards.

The first great advantage in favor of the Whitworth form of thread was in thread rolling, since a much stronger screw thread could be produced by rolling. Also, the production was entirely automatic, very fast, clean finish, reasonably accurate, and the dies would give a long life without attention better than in most methods of cutting screw threads. Then came the demand for more accurate forms of thread and the thread grinder was established.

L. H. Rhodes **was born in London. After serving apprenticeship with The Westinghouse Brake Company (England) he came to the United States and worked as a toolmaker for several Detroit firms, including Ford Motor Company and Chrysler Corporation. Returning to England, he was successively toolmaker and draughtsman with the Gramaphone Company, toolroom foreman at Phillips Radio, production engineer with Hoover, Ltd., and now, General Manager for S. Carlton Smith, Ltd., (Precision Engineering Works) Dunstable, England.**

The first machines in this country were either of Continental manufacture or American, and were of the single ribbed wheel type, and if we wished to keep abreast of the times we had to use a compromise of the Whitworth thread form and V thread form. In the early days, most English ground threads were of Whitworth form, but truncated so that the 55° angle and the radius in the core could be maintained, but the top radius at the crest of the thread could not be successfully ground so this was dispensed with. See Fig. 1. It is, however, interesting to note that a similar form of thread has been suggested as the new international thread form with angles of 55°, 57½° and 60 degrees.

In some instances this modified form produced a weak thread because of the reduced depth, and thread grinding did not advance as manufacturers were hesitant to buy expensive plant for which the product did not find favor in some quarters. To overcome this disadvantage the grinding wheel was formed —that is, the crest radius was included in both sides of the wheel. See Fig. 2.



The grinder, as described in the text. Note its modern lines and rugged construction.

**"Crush Dressing of Grinding Wheels for Form Tool Grinding—A Symposium," September, '45, The Tool Engineer.*

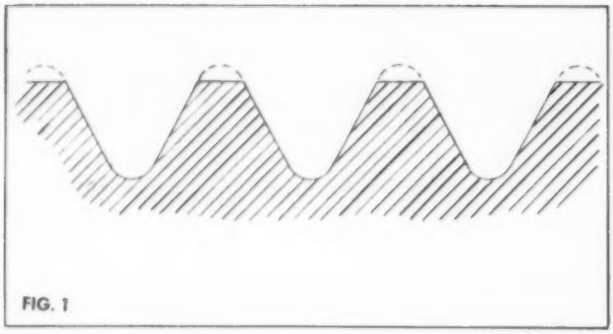
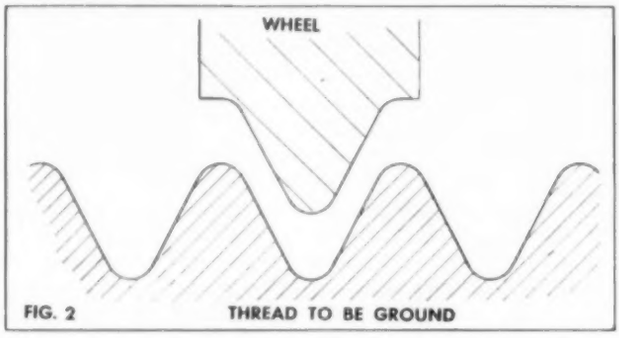


FIG. 1. Truncated Whitworth Thread as originally produced by thread grinding.

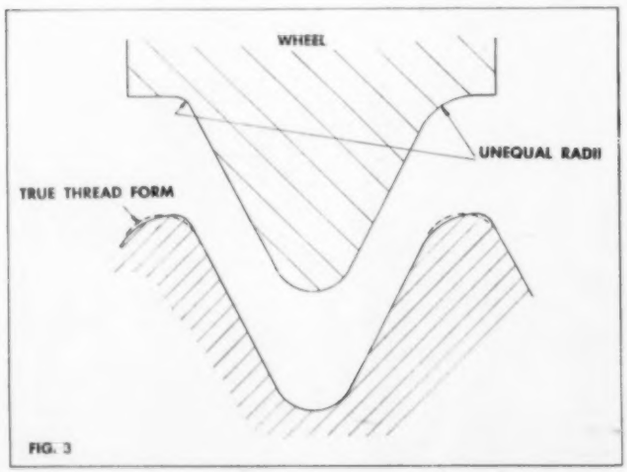
FIG. 2. A single ribbed grinding wheel formed to grind a full form Whitworth thread.



This operation was rather difficult for if the form was not exact on both sides of the wheel a bad form was produced (see Fig. 3). When these difficulties were overcome and a perfect wheel was produced another problem cropped up to make life a little more difficult for the Tooling Engineers. It was found that the start and finish of the thread form was not correct, and this was due to the side thrust of the wheel which caused the large diameter wheel to bend slightly or the wheel spindle to wander sideways.

This was due to the increased and decreased pressure which was aggravated by the radius on each side of the wheel as the cutting area had increased, and when grinding some material even the greatest care and fine feed would not overcome this as the material would burnish the wheel. The only solution to all these problems was a fully formed wheel which would produce a Whitworth form of thread without modification, and one or two of our machine tool manufacturers took up the matter in earnest.

FIG. 3. An incorrect Whitworth form of thread due to uneven radii on the grinding wheel.



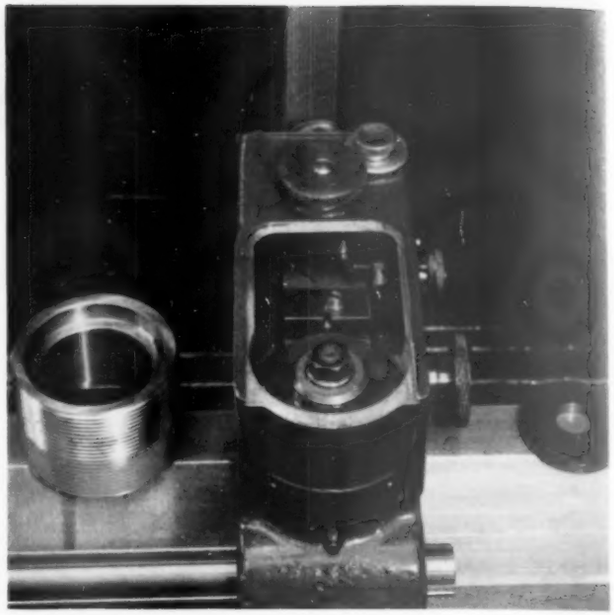


FIG. 4. The Multi-Ribbed grinding wheel dresser in action with cover removed to show profile cam in action. On the right is a spare cam which appears almost circular. On the left a partly worn crusher is shown.

It should be noted that all the efforts to produce a multiple ribbed wheel grinder could not have been achieved without the full co-operation of a few grinding wheel manufacturers, and I am of the opinion that their efforts have been magnificent. This fact was brought to my attention with a jolt when a representative of a grinding wheel concern looked at me with horror when I requested a wheel with as fine a grit as 360.

He remarked that it was impossible to grind steel with a wheel as fine as that as they recommended a much coarser grit for grinding glass. He left me a sadder and wiser man, but it occurred to me that thread grinding wheels were not popular with every manufacturer, and wheels are now used as fine as 600 grit for this purpose.

A Gradual Development

The machine installed in our Works has been gradually developed over a number of years and is a very fine precision job. I have two criticisms to offer, the first is that the whole machine now requires to be redesigned to clean up the "bits and pieces" which have been added from time to time as improvements have been incorporated, but war time conditions left no time for "fancy" work or redesigning and development of new models.

The second criticism is that the wheel head should have been made to swivel, but I will refer to this later on as no doubt the manufacturers would not agree to people like ourselves trying to do impossible jobs. (This machine has now been redesigned and the layout defies further criticism). I must make it clear, however, that I have no experience on production jobs where time is judged to split seconds. All our work is of a toolroom nature and quantities are small, but with plenty of variation and experience to be gained with many types of threads.

There are two methods of multi rib wheel thread grinding —the traverse and plunge and I will deal with them in that order.

Supplied with the machine is a very fine piece of mechanism, the diamond dressing device. This is shown in the photographs Figs. 4 and 5, and consists of a diamond dresser

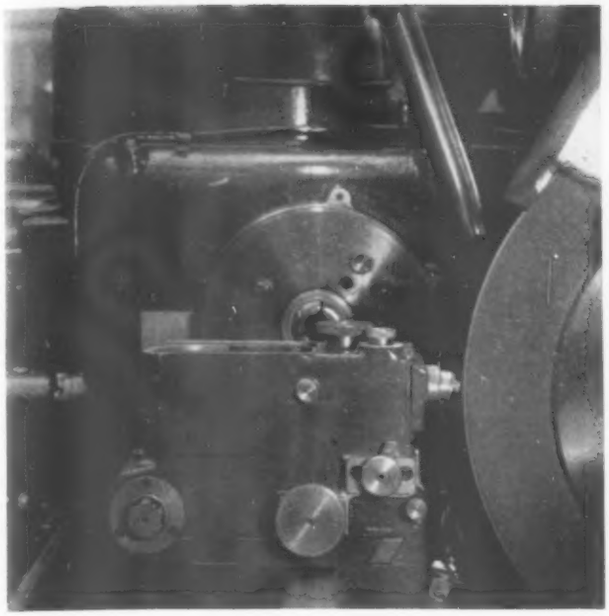


FIG. 5. End-on view of Multi-Ribbed wheel dresser in action. Ordinary grinding wheel speed is used when dressing.

which is actuated by a cam to dress the form of the thread on the grinding wheel while the whole fixture traverses with the machine table according to the pitch of the required thread.

For a Whitworth form of thread two diamonds are necessary, the first is a Vee shape of acme form, the second is a cone shaped diamond with a lapped radius and a different size is necessary for every pitch owing to the varying radius on the route of the form. It is obvious that the right size of diamond must be used to suit the cam form.

First dress the whole wheel face with an ordinary diamond and be sure the whole periphery is cleaned up, then the roughing Vee diamond is set in the fixture to correspond with the helix angle to which the wheel head is set. The traverse for the pitch is thrown out of action for the first roughing operation. The Vee diamond is first used to rough out the wheel in a succession of grooves and care must be exercised during this operation, otherwise the diamond will break owing to the stress of cutting on three sides. See Fig. 6. Where the pitch is coarse, say below 12 threads to the inch, a number of cuts must be taken (see Fig. 7), and as much as possible of the form should be roughed out to save the wear of the lapped cone diamonds which are of short life and rather costly.

Plunge Roughing With Diamond

When roughing with the Vee diamond the diamond is plunged into the wheel without the use of the dressing attachment or the traverse in action and after cutting one groove in the wheel the workhead is turned one revolution by hand with the traverse in gear, and this brings the roughing diamond to the next position according to the pitch and so on until the whole face of the wheel has a series of rough Vee grooves.

It is important that the wheel is shaped as in Fig. 8, so that no half threads are left at each side of the wheel, otherwise these thin sections will break off. This is liable to cause damage and perhaps result in a serious accident if the broken piece wedges between the work and the wheel as the wheel is liable to break and wreck the whole machine.

The best method, when roughing a wheel, is to commence as shown in Fig. 9 with the finishing side of the wheel dressed

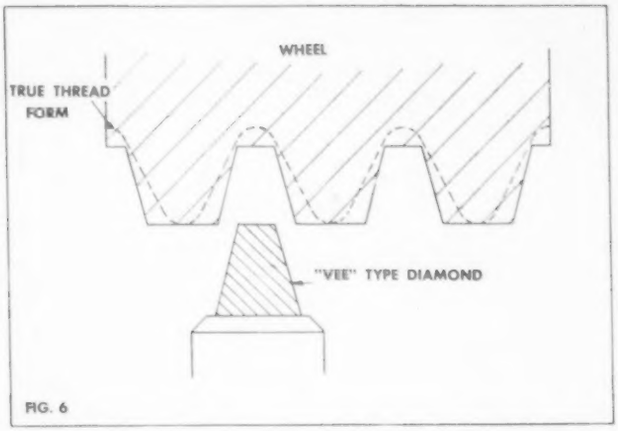
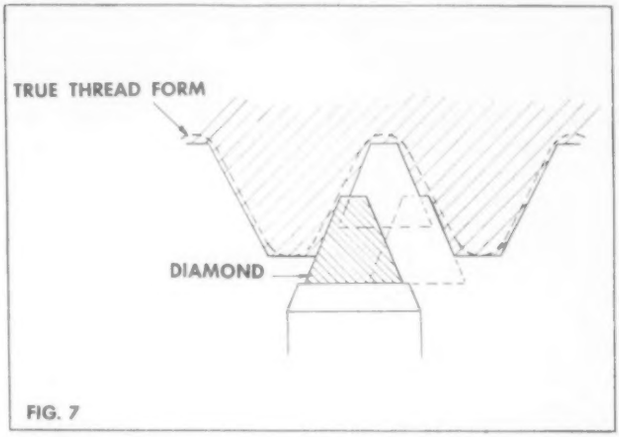


FIG. 6. First operation for roughing out a Multi-Ribbed wheel.

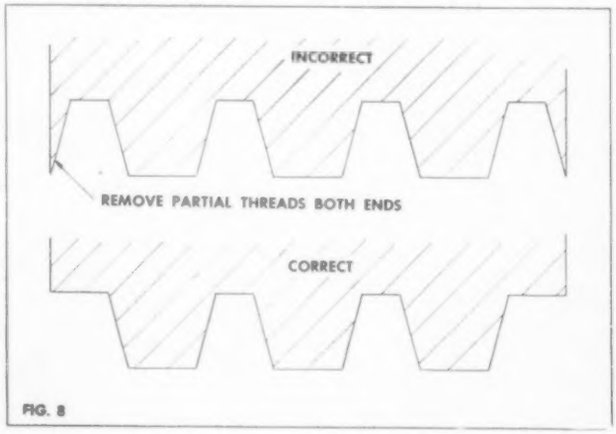
FIG. 7. Dress as much of the form as possible with roughing cuts according to the depth of thread.



to suit. After as much as possible has been removed with the Vee diamond a further roughing operation can be made with a worn cone diamond, with the device in action and the machine set to the correct pitch. Note: It is important to further dress the form, to preserve the finishing diamond as far as possible, as this will be required to keep the wheel in constant trim. It is obvious that a worn diamond cannot produce a correct form and constant check on the diamond with a microscope is necessary.

A coned diamond should be constantly turned in its holder as the radius wears until this has worn all around. With

FIG. 8. It is important that the wheel is dressed as shown and that all part ribs are removed from either side of the wheel.



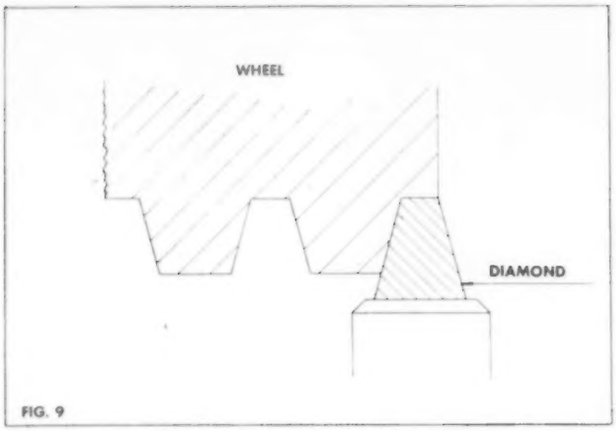


FIG. 9. The best method to commence to dress a wheel is shown above.

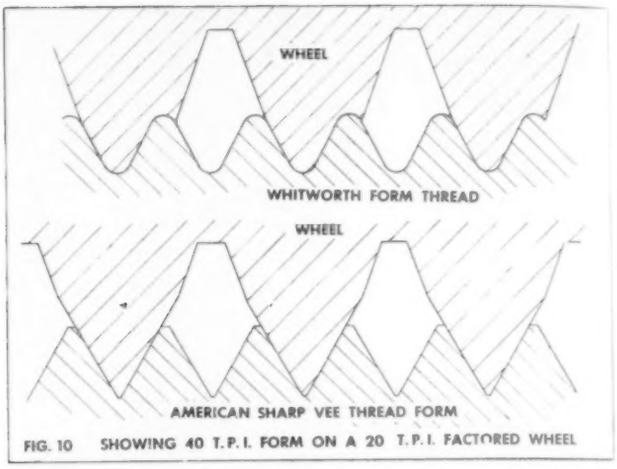


FIG. 10. The factored wheel for grinding fine threads or using the same wheel for 20 T.P.I. and 40 T.P.I. or any multiple.

regard to the amount that can be safely removed, without damage to the diamond, there is no hard and fast rule. Of course the manufacturers of diamonds recommend the absolute minimum and they say that the wear of diamonds is due to excessive cuts, but from practical experience cuts of about .0005" are maximum, but I prefer a number of cuts—about .002"—when dressing a new wheel and this has proved to be the most economical.

When dressing wheels of fine pitches, say 40 T.P.I., a great saving can be effected by truing half the number of ribs on the wheel or any desired multiple according to the amount of work to be carried out. This is shown more clearly in Fig. 10, and assuming we have 40 T.P.I. to produce, an old wheel of say 20 T.P.I. can be used to save roughing and final dressing time.

Owing to the time required for dressing fine threads it is usual to dress all fine thread wheels in this manner, even crushed wheels, but it is not quite so simple as it appears on Whitworth form of thread, but take note, as you Engineers in the States may suddenly become very interested in the Whitworth form at a future date. The roughing diamond should be the correct size and checked on a projector for depth of cut, otherwise the crest of the form will be incorrect.

Multi-start threads present no difficulties by the multi-rib thread grinding wheel, and this is quite a simple operation. Assuming a 20 T.P.I. thread, 4 start lead is required, the wheel is first dressed for 20 T.P.I. in the ordinary way. All that is necessary, once the wheel has been dressed for this pitch, is to change the lead gears on the traverse to 5 T.P.I., but it is important that the helix angle is set for this lead—then proceed to grind in the ordinary way.

It is assumed that after dressing the wheel a thread of say 2" long is to be ground. It may be possible to grind this in one cut if great accuracy is not required such as for component parts. In this case the machine can be left set, and it is only necessary to set the stops for the automatic throwout and withdrawal of wheel. At the commencement of the operation bring the wheel into full depth of the thread just clear of the job and commence the traverse.

The amount of thread that can be ground before redressing is required will be proved by experience, and is dependent on many factors such as the material being ground, the grinding wheel used, coolant, diameter of part, accuracy necessary, depth of cut, length of component, and if the thread is required to be finished up to the end without taper. This latter point is important because the grinding of threads can be considerably speeded up if a lead can be put on the wheel (see Fig. 11). This can also be seen on the projection photograph.

In the complete pass-over method of grinding this presents no difficulty, but where a thread stops part way along the

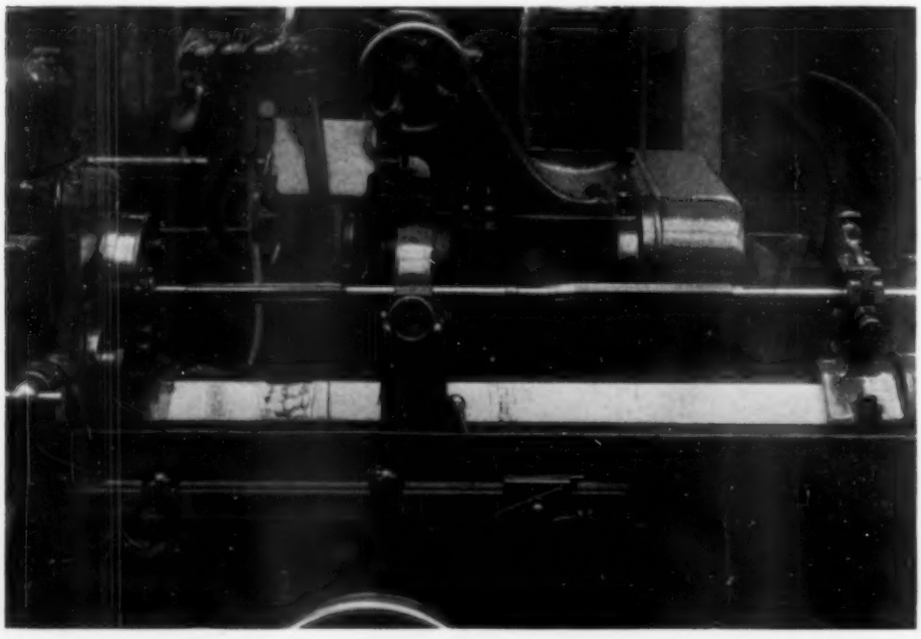


FIG. 10-A. The thread grinder in action (guard removed). This is the final cut. The whole of the bed and work-head rocks to and from the wheel to produce relief on the tap. As the tap was too long, i.e., 6 ft., to go between centers it was held in a collet and two steadies. The tap was reversed for grinding the other end. Note the small band thread ground for picking up the reverse end. The microscope has been removed.

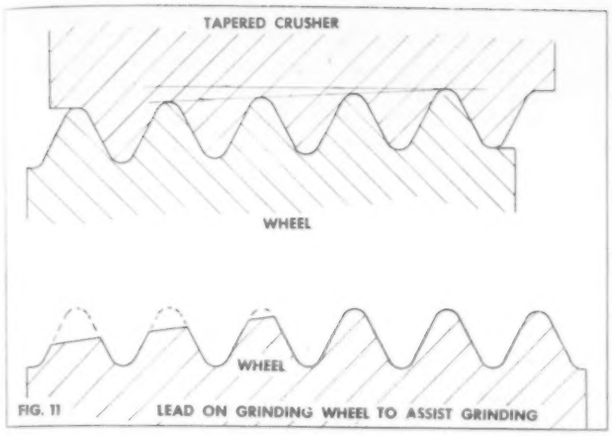


FIG. 11. Grinding can be speeded up considerably by using a lead on the wheel. The tapered crusher is often an advantage on large pitches.

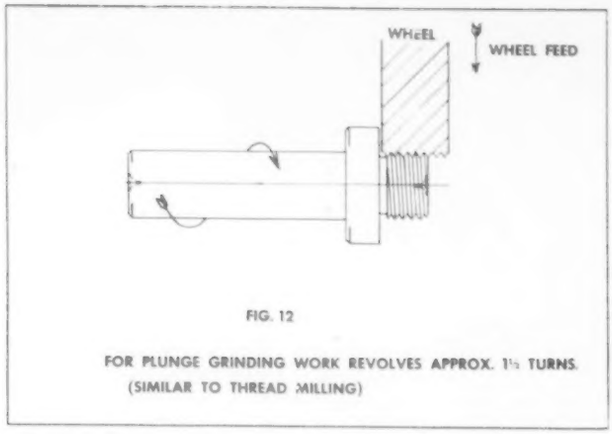


FIG. 12. Plunge grinding as above cannot be combined with the pass-over method, and is usually employed on production where great accuracy is not required.

component this method may prove undesirable, and more frequent dressing is necessary. Strange as it may appear the thread form on the wheel does not wear to any extent, but burnishing takes place and necessitates the need for re-dressing. This must be carefully watched, as two troubles will occur. If the part being ground is of hardened steel this will soften the steel and also set up surface cracks, but these are not always visible as the parts appear bright and clean with a high finish.

Also on a long component the increased pressure will bend the work towards the centers and the effective diameter will vary throughout the whole length. The same will apply on any long job and it is often necessary to take two or more cuts for this reason alone as, although we have tried steadies to overcome this trouble, we have not met with great success.

Plunge Grinding is Fast

Plunge grinding is a fast method of producing short threads particularly where the component is shouldered. See Fig. 12. By this method only 1 to 1½ turns of the work is necessary and the grinding wheel must be wider than the thread to be ground. When grinding by this method the helix angle must be compensated for on the crusher or dresser as it is not possible to grind with the wheel set at a helix angle by this method as a tapered thread will result. Those of you who are familiar with thread grinding will know that it is often possible to correct the effective diameter and form of thread by a slight alteration of the helix angle setting of the wheel.

The American Vee thread and Metric International thread are very easy to produce by the multi-ribbed wheel, and the large boiler stay taps in the display photograph are ground with this form of thread.

The procedure is the same as for Whitworth thread with regard to dressing, but where great accuracy is not of importance the Vee diamond can be plunged into the wheel without the use of a dressing device. This is not usual, however, as the form of thread varies with the helix angle and the diamond would have to decide the form on the finished product. The same problem arises when tilting a tool when screw cutting on a lathe.

When grinding Vee threads it is the general practice to specify a core diameter of less than a certain figure and, providing the radius is small enough at the root, it is not of great importance; the outside or major diameter is, of course, ground to size before thread grinding. In this case a sharp Vee diamond is necessary to form the wheel to clear the major diameter. No radius is required as this is dressed on the crest of the grinding wheel thread form by cam action. Where a factored wheel is used for fine pitches it is recommended to use a diamond of less than thread form angle, i.e. 60° for roughing, and the wheel is dressed as in Fig. 12.

The Multiple Ribbed Wheel Crusher

The foregoing has described the method of grinding accurately for the production of gauges and crushers and similar

FIG. 12-A. The crusher is in action but the lubricant has been turned off for photographic purposes. The wheel drives the crusher which must be wider than the wheel. The guard has been removed for clarity. Note the lead on the ribs of the grinding wheel.

jobs for small quantities as applied to work of a toolroom nature. For the grinding of taps and similar components where limits are not below .0002" the crushed wheel is supreme.

The grinding of threads by crusher methods is a very simple operation and there are several machines on the market designed for use with crushed wheels only. All types of threads can be ground by this method including acme, buttress, multiple start and very fine threads, also the pass-over or plunge-cut methods of grinding can be employed.

The method of dressing the wheel can be varied, but it is best to remove as much of the groove as possible with a diamond plunged into the wheel and leave as little as possible for the truing up by the crusher. The life of the crusher is not long where accuracy is required but this can be prolonged by careful use. It is essential that the crusher is wider than the grinding wheel (see Fig. 10-A), and note that half threads must be removed from the sides of the wheel as previously explained.

Procedures for Dressing

If possible, the crusher should be one and a half wheel thickness and large in diameter, but the diameter is limited to about one and a half times the length. It is obvious that the crusher must revolve freely without any side movement whatever, and the larger the diameter the greater the tendency for side movement to creep in. Any slop in the crusher will cause the thread on the wheel to become wavy, and this will also occur if the wheel is very badly burnished or excessive pressure is used in crushing.

This trouble of a wavy wheel form is very misleading and difficult to discover, so if you are unable to get your correct thread form after a successful run, before renewing the crusher, clean the whole wheel with a diamond to remove the burnished surface of the wheel and completely redress.

When fitting a new crusher, commence to dress on the extreme left so that, as the crusher wears, progress on the thread to the right and you can be sure of the last thread on your grinding wheel being of correct form, and this is all that is really necessary when grinding by the pass-over method. In plunge-grinding the whole surface of the wheel must come in contact with an unworn part of the crusher, otherwise the last threads on the component will be incorrect—that is, of bad form or tapered.

When dressing the wheel, feed the crusher down while the wheel is stationary, otherwise skidding will occur and will grind flats on the crusher which will be damaged and result in short life. About .002" feed down on the crusher is all that is necessary for retruing the wheel, but do not run them together excessively.

Only practical experience can tell how and when to crush the wheel as no hard and fast rules apply, but after a little experience this can be felt and judged quite easily. It is of course essential that oil lubricant is used, with a brush or other means to keep the crusher clean. The grit from the wheel can ruin the crusher if not disposed of, and this is one of the secrets of all crusher grinding methods.

In order to assist on fast production, the number of cuts can be reduced by putting a lead on the grinding wheel, as previously explained, and this can be done by two methods. See Fig. 11. After the wheel has been dressed in the usual way an angle is dressed on the leading edge of the wheel and only the last two or three ribs are left full form.

Another way to achieve this is to have the crushers ground tapered and, although this is much the better method in many respects, they are most costly to produce and have the disadvantage that the last rib on the wheel has to be relied upon to produce the correct size and form.

Although this is extensively used in some instances, we prefer the former method as all crushers can be kept standard and used for either pass-over or plunge-cut grinding. The lead on the wheel is clearly shown on the projection photograph, Fig. 13, and for those of you who have the eye of the American eagle you need not write and tell me that the pitch is slightly out with the template.

In order to make room for the camera in the projection room we projected a 2 m/m pitch test plate with a 24 T.P.I.

FIG. 13. The lead on the wheel can be clearly seen and assuming the white of the screen is the wheel the amount necessary can be judged. The template gives the profile for taps and screws. There is a slight pitch error in the photograph as explained in the text.

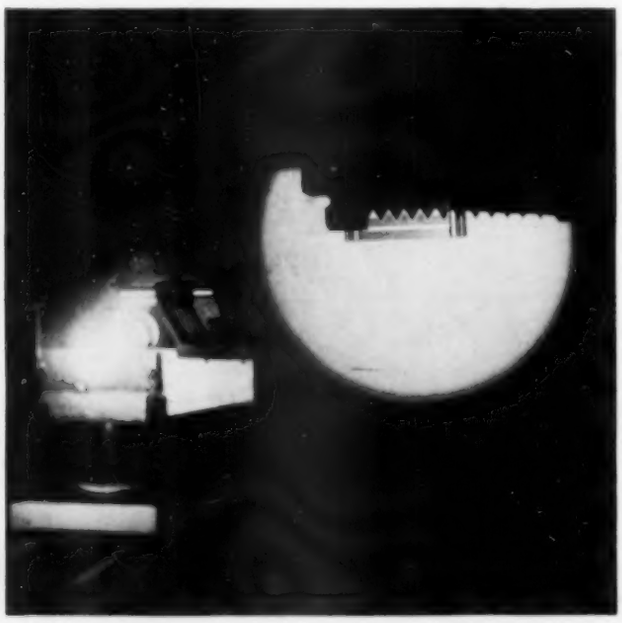
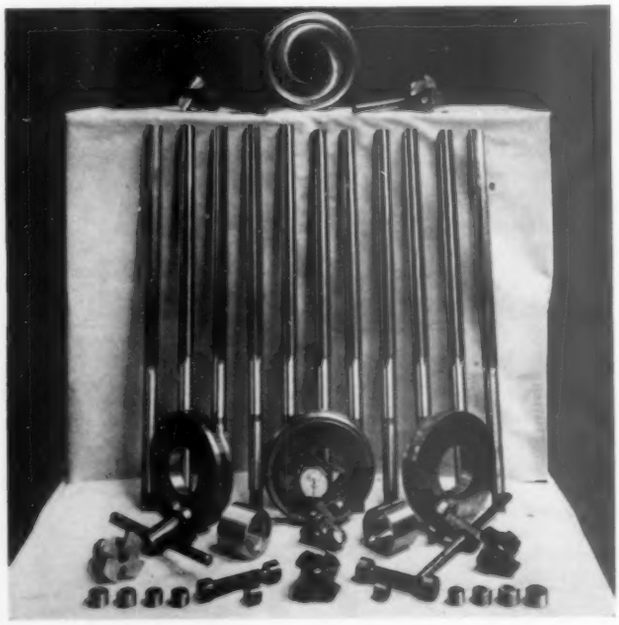


FIG. 14. A few samples of thread ground parts collected at random during a visit by the photographer. With the exception of the gauges and crushers all these parts were ground on a crushed wheel. The small test pieces were used for checking the effective diameter in conjunction with the hand comparator shown in the centre. These were necessary as all taps had five flutes. The large gauges have buttress threads and were hardened and then ground with single ribbed wheel. We succeeded in producing a perfect form with the angle at 90° to the axis.



template and the magnification was made to suit. We did not trouble to get this exact as the photographer assured us this slight error would not be seen, but his eye is not so keen as a Tooling Engineer, as attested by having our attention repeatedly called to this error.

This reminds me that multi-ribbed wheels are easy to check for accuracy of form, and it is not necessary to grind a test piece to check this. What we have found to be the easiest method is to obtain a strip of steel similar to a safety razor blade and push this into the wheel by hand and project this form on the straight projector—that is, without setting the projector for the helix angle.

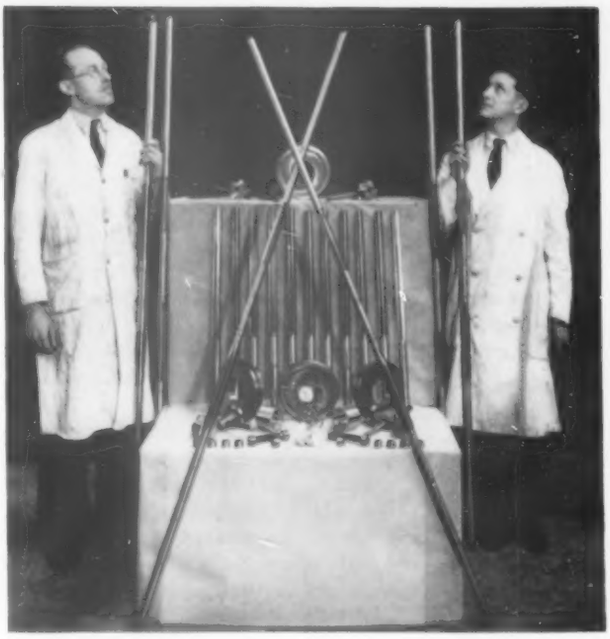
Lastly, do not attempt to touch the thread form on the strip after grinding on the wheel, but leave the oil and dirt on, otherwise any attempt to remove this will cause dust to collect on the thread form, and it will be impossible to see the enlarged profile clearly.

For those of you who may think that multi-ribbed crushed wheel thread grinding is not practical on fine threads, I should like to state that in this country we are now grinding taps and screws as fine as 20 B.A. threads and for those of you who are not familiar with the metric British Association screw threads, the size is .0189 inch diameter, .0047 inch pitch, .0028 inch depth of thread, Whitworth form, angle 47½°.

Without doubt multi-ribbed wheel crusher thread grinding proved its value in the war, and the possibilities have not been fully explored yet, but it is becoming very popular and will in time, I think, supersede all previous methods with possible exceptions. The single-ribbed wheel is still considered to be more accurate by some engineers, but I have not met with any job that could not be ground by multi-rib wheels with accuracy equal to that obtained by any other method, but of course the machine and equipment must be of the highest quality.

The exceptions would be in very large threads, particularly Buttress forms, and we claim to have made the first hardened buttress thread gauges for the Woolwich Arsenal Ordnance Department. These are shown in the display photograph. I mentioned earlier that it would have been an advantage if the wheel head were made to swivel, and this was for grinding large form buttress thread gauges, as the side thrust on the wheel prevented the production of the straight side of the thread. The difficulty was overcome in a similar manner that a face can be dished-ground.

The action photograph (Fig. 10-A) shows a 6-ft. long boiler stay tap being ground, and we believe we are pioneers in this field. These taps were of the same pitch and were made in steps of 1 m/m from 22 m/m to 35 m/m. The specification of the tap was, first pilot 1 m/m below core diameter for 26 m/m thread, with the threaded part tapered with reamer lead to core diameter. The thread also had a tapered lead.



Display of long taps ground by crushed dressed wheels.

The centre part held by the first steady was also a pilot for the second tap of 32 m/m, this pilot was again 1 m/m below core diameter with reamer and thread lead. The tapers and reamers were finished ground after thread grinding. The pitch of thread was the same for both parts but had to be continuous as for one long thread.

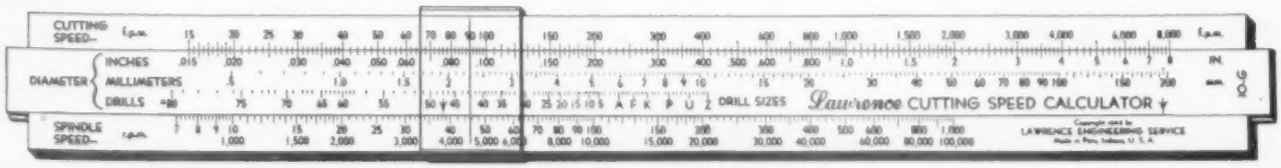
The limits were .0005" on all diameters, .0002" on effective diameter and .0002" on pitch in one inch. The thread was also relieved to .002" back off on the five flutes. The taps were ground by the crusher method and the close up photograph, Fig. 12-A, shows the cover removed and the crusher in action; the lead on the wheel can also be clearly seen. This tap had previously been roughed out in one cut and is ready for final grinding. The wheel is taken to the extreme right clear of the thread before commencing to grind.

I am afraid that it is not possible to state all the details of multi-ribbed wheel grinding, but it is not difficult on straight forward work, and if the machine is built for crusher grinding only and is of simple design it should be no more difficult than plain grinding. A machine of this type could be set up for production work and used by unskilled operators, and the makers of our machine claim a thread of 5/8" long, 3/4" diameter x 16 T.P.I. of stainless steel can be plunge-ground in 43 seconds, but I am sure you will be able to beat that in the States.

New Cutting Speed Calculator Available

Cutting Speed Calculator, by Lawrence Engineering Service, 116 Snyder Ave., Peru, Indiana, facilitates selection of proper spindle speed, whether drilling, reaming, milling, turning or grinding. With three diameter scales graduated in inches, millimeters, and drill sizes, the device handles cutting speeds from 15 to 8,000 fpm, diameters from No. 80 drill (.0135") to 8", and spindle speeds from 7 to 100,000 rpm. This calculator should effect savings in time and materially reduce the number of burned and broken tools.

To operate, set diameter on center slide—in inches, millimeters or drill size—under desired cutting speed, then read spindle speed at arrow indicator on lower scale.



By P. H. Winter

Electrical Circuits for Automatic Tools

Increased Production, With Greater Safety and Less Operator Fatigue, Effected with Engineered Controls

HAVING DISCUSSED THE fundamentals of electrical circuits in previous issues,* we will now illustrate their application in specific installations. In order to make it easier for the reader to understand the "why" of every hook-up shown here we will show the development of the installation step by step.

Mr. Winter

It was required to design a special machine of the continuously moving rotary type which (1) would be hand loaded; (2) in which clamping pressure would be applied to the workpiece automatically and (3) where the workpiece would be ejected automatically after a predetermined length of time. See Fig. 1. The pressure was applied to the six work stations by means of air cylinders and a valve hook-up that presented no particular difficulty. The problem appeared in the automatic ejection since the workpiece was a flat steel plate with no projections to permit lifting it. A simple solution was to use lifting electromagnets "A" built directly into clamp shoes "B."

Automatic Work Ejection

After the part is loaded into the work station (the table rotating continuously) the air cylinder closes the clamp. At this time limit switches "C" are open and the electromagnets non-operative. As the table rotates, each work station in turn reaches a point where the air cylinder opens and lifts the clamp shoe. Just prior to this point cam "D" (attached to the stationary center column) closes limit switch "C" and energizes magnet "A."

As the clamp shoe lifts up, the magnet raises the workpiece with it. As the station passes over the discharge chute "E" cam "D" opens the limit switch "C" and the part drops onto the chute. Since the magnets and switches are mounted on a rotating table current is supplied through brushes "F" and slip rings "G," an arrangement similar to the slip rings on motors and generators. The circuit is wired as shown in Fig. 1-A.

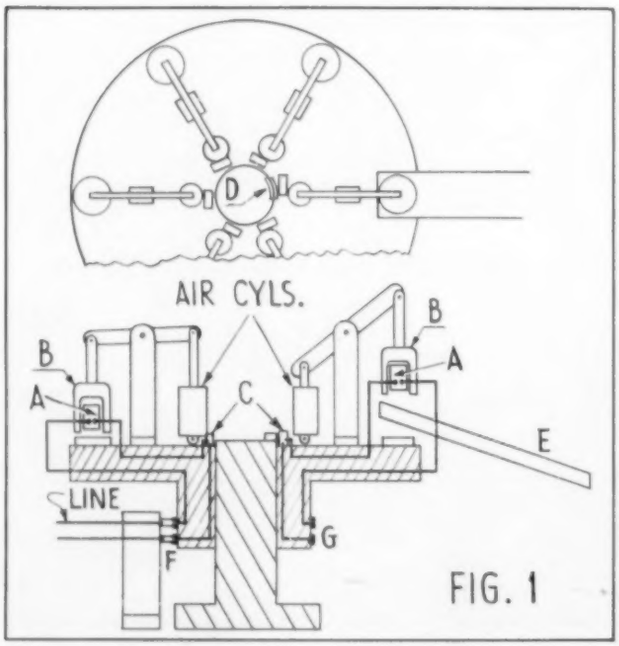


FIG. 1

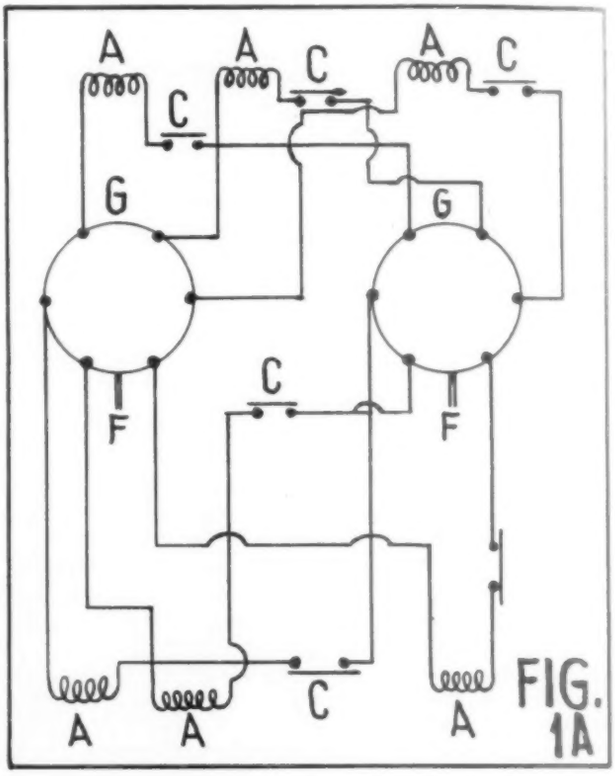


FIG. 1A

A problem involving motor control was encountered in the design of an automatic indexing fixture to be used with a standard spot welder. See Fig. 2. It was desired to use an indexing rotary table that would be hand loaded, index to the welding position, weld, index and automatically eject. The indexing was to be accomplished by means of a continuously running motor "A" driving a Geneva index dog "B" through a speed reducer "C." One revolution of the index shaft would turn the work table one index position.

Safety Incorporated

The electrical problem resolved itself into the following items: (1) to start the welder electrically at a given point in each index. Only one short electrical impulse was required to set off the welder timer which would then lower the electrode and retract it after a set time interval. (2) To make sure that the welder electrode had been raised before the table began to move to avoid mechanical interference. (3) To make sure that the part to be welded was lying flat to prevent distortion by the welding pressure.

It was decided to mount a trip cam on the index dog "B" to set off the welder, since "B" controlled the position of the

**April and August, 1946,* The Tool Engineer.

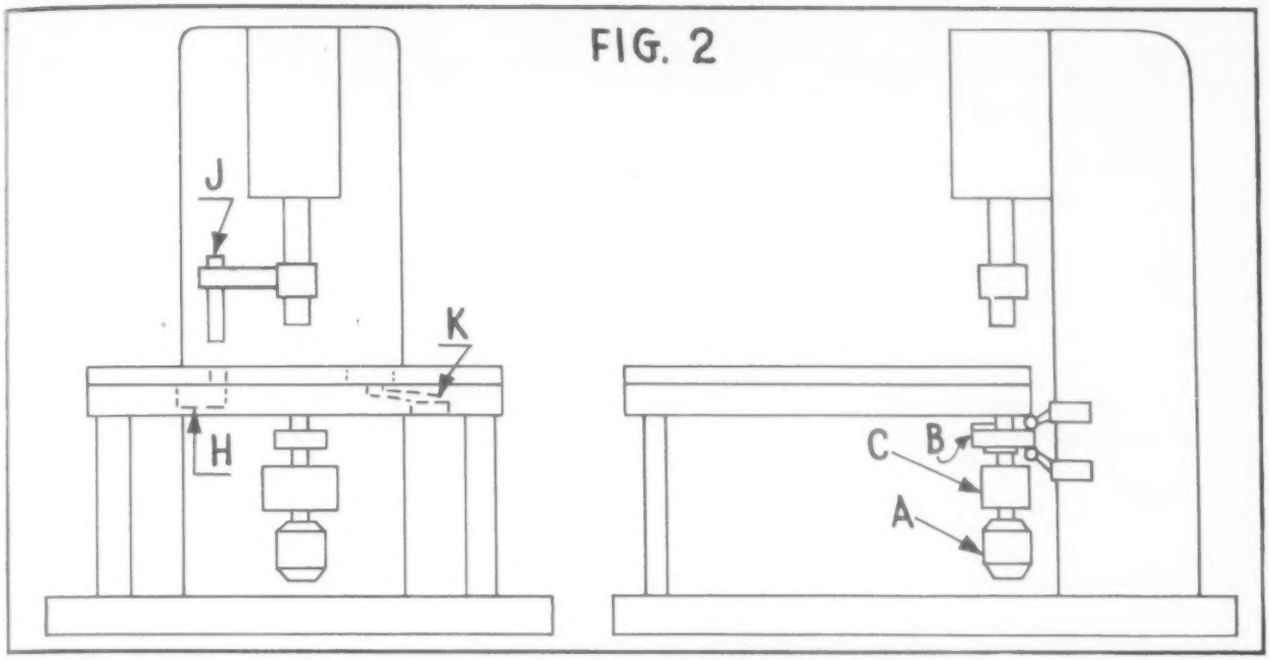


FIG. 2

work table. Safety features (2) and (3) were to be accomplished by stopping the driving motor if either the electrode had not been raised or if the part was not lying flat. Since the motor should start up as soon as the welding head had been raised, this control was wired directly into the power line, whereas if the machine stopped due to a part not lying flat the operator was to manually restart the motor to avoid injury. This indicated placing this control in the motor control circuit.

The enlarged view of "B" (see Fig. 2-B) shows cam "D" which operates limit switch "E" to start the welding cycle at a fixed point every revolution. Cam "F" operates double throw switch "G" so that the cam will close the normally open contact just before the Geneva index begins to move the rotary table. A normally closed switch "H" is connected with this double throw switch and opened every time a rod "J" attached to the electrode comes down.

Since the parts rest on a ledge in the table in a recess that is open at the bottom, a limit switch "K" slides over the bottom and opens every time a part does not lie flat and permits the switch arm to move up. The function of the whole hook-up can be shown by following the wiring diagram shown in Fig. 2-C. It may be noted that a single phase motor is being used and since it is a ½ hp motor only, the motor current can be handled directly by switches "G" and "H."

After pressing starting button "L," contactor "M" closes and starts the motor. Geneva index "B," Figures 2 and 2-B, rotates, and as long as it moves the work table, cam "F," Fig. 2-B, closes the normally open contact "P" on switch "G," passing the motor current through "H" to the motor. Just before "B" stops turning the table, cam "F" permits switch "G" to snap, passing current directly to the motor. Cam "D" now closes switch "E" starting welding cycle.

When the electrode is down, rod "J," Fig. 2, opens switch "H" which has no effect at this time. The welder is timed to withdraw the electrode before "B" moves the table again. At this moment cam "F" snaps "G" back to contact "P" and if the electrode has not been withdrawn at this time switch "H" is still open and the current to the motor is cut off and the motor stops. As soon as the electrode is raised the circuit is reestablished and the motor restarted. Switch "K" is wired into the stop button circuit. When it opens due to a part being out of position it has the same effect as pressing the stop button and stops the machine until the operator has corrected the trouble and is ready to start again.

Another interesting job was the design of an automatic drilling machine for wooden frames. Since the hole spacing was very close, a battery of air drills was used as their diameter was appreciably less than that of electrically driven drill heads. In order to simplify the design it was

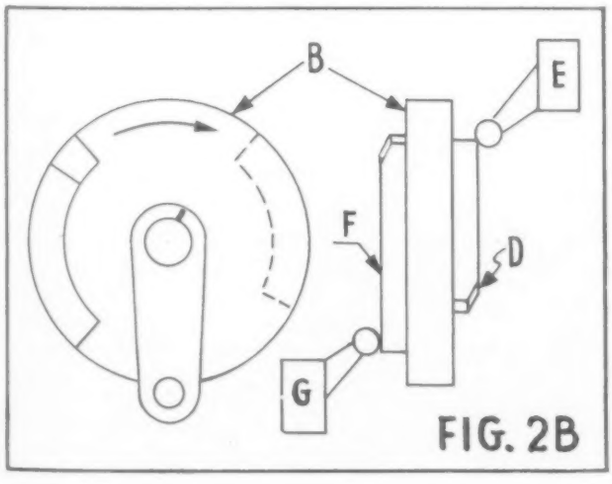


FIG. 2B

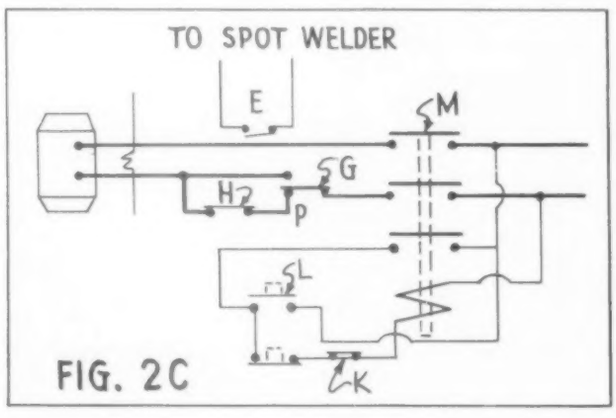


FIG. 2C

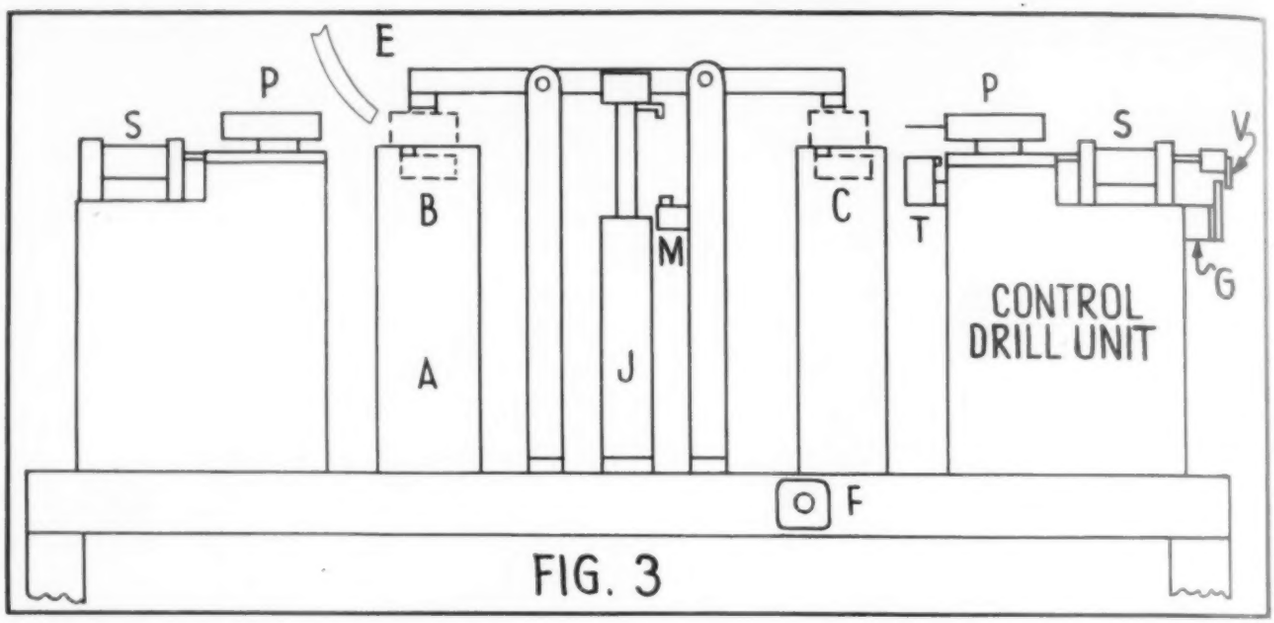
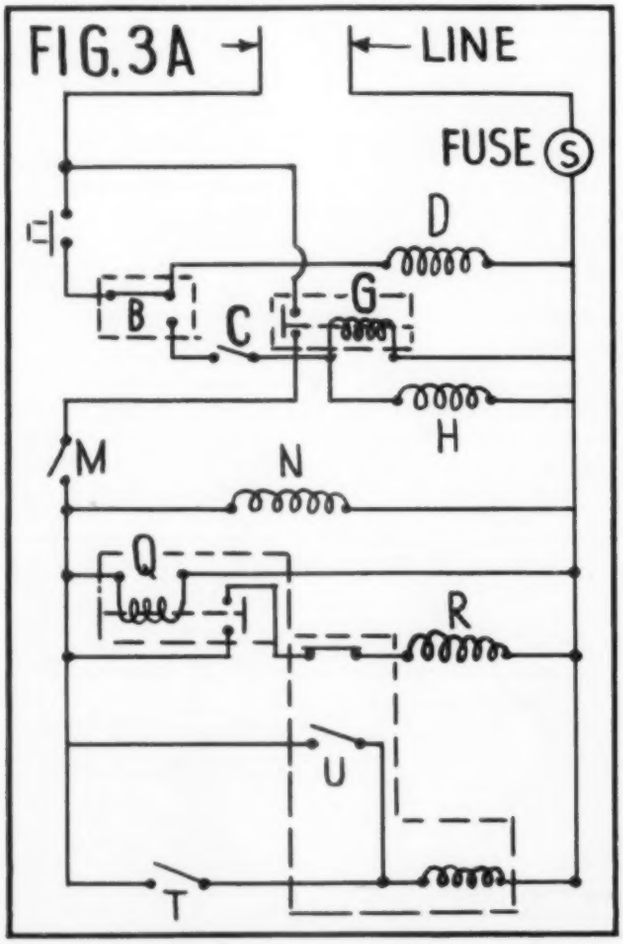


FIG. 3

decided to use air for all operating mechanisms and to control it by means of solenoid operated valves.

The operation sequence was to be as follows: The operator used a blast of air to clean off the machine, placed the frame into the machine (a device assuring the correct positioning of the work), and pressed a push button. The machine then automatically clamped the frame, started the drill heads rotating, fed them to a definite depth, withdrew them, shut off the rotation of the drills and unclamped the work—loading and unloading both manual.



Since one of the holes drilled was about 3 times longer than the others it was safe to control the cycle from the movement of its drill head alone and let the other drill heads start at the same time and finish ahead of it.

The general layout of the machine is shown in the schematic diagram, Fig. 3. Here, the necessary relays and solenoid valves are not shown since they were actually placed on a separate control panel and their function can best be illustrated on the wiring diagram, Fig. 3-A. The frame is placed on a platform "A," Fig. 3, and, if properly positioned, closes limit switches "B" and "C." This permits the rest of the circuit to function and therefore acts as a "fool-proofing" device. "B" is a double throw limit switch whose normally closed contact is connected to solenoid valve "D," Fig. 3-A, which operates air blast "E" as long as the frame is not in position and push button "F" is pressed.

When the frame is properly positioned and "F" is closed, self-locking relay "G" is closed and remains closed after the push button is released. Solenoid valve "H" is also energized and actuates clamp cylinder "J," Fig. 3. This comes down and clamps the work and closes limit switch "M." Current now flows to solenoid valve "N" which admits air to the drill heads "P" (only 2 are shown) and starts them rotating.

At the same time, time delay relay "Q," Fig. 3-A, is energized and after a time interval long enough to permit the drill heads to come up to speed, solenoid valve "R" is energized and admits air to feed cylinders "S," Fig. 3, which feed the drills into the work to a positive stop and on the control drill unit to limit switch "T." When this is closed, double throw relay "U," Fig. 3-A, is energized closing its normally open contacts and opening its normally closed contacts. The latter cut off current to valve "R" and spring action reverses the flow of air causing the drill heads to withdraw.

The self-energizing action of relay "U" holds these contacts open preventing a return of the drill heads as soon as limit switch "T" opens due to the withdrawal of the heads. As the control head withdraws, latch "V," Fig. 3, opens the contacts on relay "G" which has a special arm for this purpose. Latch "V" is so designed that it overrides this arm on the instroke but opens it on the return. Opening "G" de-energizes all valves, stopping the drills rotating and causing the clamp cylinder to open the clamps.

By **W. J. Fisher**

Tools and Their Importance to Our Economy*

Productivity, Per Man Hour, Must Be Increased to Effect Economic Balance

RECENT DEVELOPMENTS are a challenge to Tool Engineers if we are to get our industrial establishments back on an economically sound basis. Costs are mounting, and the only answer is greater production per man hour through better methods and better tools. There is no other way that our present standard of living can be maintained at its present level, and certainly there is no other way to improve it.

You and I know that the finest machine tools are of no avail unless they are properly equipped with tools and fixtures. Therefore, I have no hesitancy in making the statement that Tool Engineers have an important contribution to make toward our present situation.

Wm. J. Fisher **started with A. B. Farquhar Co., Ltd., over 40 years ago as machinist's apprentice, meanwhile taking night courses in engineering. Transferred to the Engineering Dep't, he became in time department foreman, general foreman and plant superintendent. In 1932, he was elected vice president and general manager. In 1944, the company was incorporated under the name of A. B. Farquhar Company, when Mr. Fisher became President and General Manager.**

Much has been said about our standard of living. As a matter of fact, it is a never-ending process which started at the beginning of time. According to the Book of Genesis, God created the earth and all that therein is; so that with creation, all of our natural resources were of the earth. Then came man, endowed with power to use these natural resources for his own good.

As mankind, through the application of labor, used these natural resources for his own benefit, he developed his mind; and in the process of this development, which we call education, ways and means were found for applying labor more efficiently. Thus, our standard of living has gradually improved. In my opinion it will continue to improve only as we are able to improve the efficiency and effectiveness of the labor of each one of us. May I repeat—there is no way under the sun to improve our standard of living except by a more effective use of manpower so that production per man hour can be increased. This was a fundamental truth at the beginning of time, and it is a fundamental truth now.

You men, together with designers of machine tools and all manner of capital equipment, have made a substantial and most important contribution to the ever-improving standard of living. Although a sudden and unexpected increase in costs has been thrust upon us, I am confident that the Tool Engineers of our various establishments will be able to meet this challenge with suggestions for better tools and better methods. Then, I am sure it is the hope of all of us that, through sound reasoning and sound management, costs will go down, real wages and real income will go up, and more of the things we make will be put into the hands of more people who need and want to buy them.

Part of the time which I served as a machinist apprentice was spent at toolmaking. I can recall that at that time the tool room foreman was both designer and toolmaker and did the blacksmith work of hardening and tempering (the expression "heat treating" was not yet in use). Therefore, the tool room foreman was "the whole works." As industrial progress was accelerated, the old method became obsolete and the highly skilled profession of Tool Engineer came into being. This profession, in my opinion, has had as much to do with our industrial progress in the past and will have as much to do with it in the future as any of the other professions in industry.

A Challenge to Tool Engineers

Earlier in this address I made the statement that the present situation in which we find ourselves, one of rising costs, is a challenge to our Tool Engineers. To this I would like to add that it is no less a challenge to machine designers and to management. The war has developed many new and lighter materials, and the use of these by our machine designers is necessary if they are to meet their responsibility in this fight against higher costs. The war has also developed many new and better steels, for cutting tools, so that heretofore unheard of speeds are now obtainable. It is the responsibility of Tool Engineers to keep abreast of these changes and recommend their use where practical to help decrease costs.

In my many years of experience in engineering and production, I have seen the development from the "hit or miss" principle of tool design and production methods to the well organized department of Tool and Methods Engineers. Now I can safely make the statement that, in regard to either the cost factor or the final results, the well organized department is by far the most favorable arrangement.

In the organization of a Tool and Methods Department, I do not suggest that it operate absolutely independent of the foremen where tools are to be used, but rather that it operate in co-operation with him. This opinion is based on my own experience as a foreman, which has shown me that it is much easier for a foreman to make equipment work if he is made to feel that he is a part of an idea which will increase production. This is an instance in which the old laws of human nature come into play.

In these days when the lowering of costs is so important, tool engineering needs the support and encouragement of management and a "pat on the back" when a good job has been accomplished. In the field of tool engineering, management—and by this I mean top management—has a definite responsibility. A well organized Department of Tool and Methods Engineers is anxious to make its work as effective as possible. By this statement, I am expressing a deep-seated personal feeling that the average employee is interested in the company he works for and in its over-all success.

You have often heard the expression "hitch your wagon to a star"; it is often used as a motto by graduating classes

**An address, delivered by the author, at Central Pennsylvania Chapter, A.S.T.E.*

in our high schools and colleges. It means nothing more or less than setting a goal for personal attainment. It is common practice for the chief executive of an industrial enterprise to set goals and objectives for the various departments to reach. Therefore I believe it is good practice to set goals and definite objectives for our Tool and Methods Engineers; and as these objectives are reached, a department of this kind becomes an asset to the entire enterprise and a justifiable overhead expense.

We follow this practice in the Farquhar organization and the department makes monthly reports of the dollar savings that have been effected as a result of the work of the department. Thus we have a definite check as to whether the department is an asset or a liability; and there never was a time when knowledge concerning the effectiveness of overhead departments was so necessary as at the present time.

Too often, and especially before the war, top management was guilty of refusing to take the advice of Tool Engineers when they recommended capital expenditures through which their efforts would make a substantial contribution toward reduction in costs.

Tool Engineers and Management

It is the responsibility of Tool Engineers to make a reasonable presentation to executive management to justify expenditures that are necessary to carry out their recommendations. This presentation should include all elements of cost in a given project, savings that can be expected, and the length of time it will take to make the expenditure self-liquidating if the appropriation is made. If, upon a presentation of this kind, a project shows that it will pay for itself within a reasonable time, it is quite difficult for executive management to give a negative answer.

This kind of a presentation has an added advantage in that it sets a goal from the standpoint of expenditures. It has been my experience that, when we set a goal for ourselves, we strive to attain it. As I said earlier in this address, it's like "hitching your wagon to a star."

During the war, most of our industrial organizations were faced with the manufacturing of materiel with which we were unfamiliar. Many of us had to work to tolerances and exacting specifications that were entirely new to us and the complications at times appeared to be almost insurmountable. But with the help and untiring efforts of the Tool Engineers we achieved a production that, before the war, would have staggered our imagination.

Thus, the Tool Engineers made a substantial contribution to the winning of the war and did their share toward changing the expression, "too little and too late," to the one we were all striving for, "plenty and on time." The fact that the Tool Engineers could accomplish so much in so short a time should give us renewed hope that we can successfully meet the challenge of post-war production problems.

There seems to be an impression abroad in this great country of ours that, because of a pent-up demand, competition does not exist. I do not agree with this impression. I firmly believe that any legitimate, well-managed business considers integrity as its best asset, and honest dealings with its customers its best goodwill builder; and that in accordance with these principles, competition between businesses, managed on a sound basis, still exists. On the other hand, I believe that as this pent-up demand comes closer to being satisfied, competition will undoubtedly be keener than it is at the present time.

It is this situation to which each individual enterprise must look forward. If we are to maintain a high level of employment when that time comes, the efforts of Tool Engineers will have to be even more effective in the future than they have been in the past. I am sure that Tool Engineers, as well as all the rest of us, desire to see a high standard of wages maintained. This will be possible in proportion to our ability to increase production per man hour through better tools and methods.

Therefore, I suggest that the place occupied by the Tool Engineers in our national economy in peacetime production is an important one—in fact, even more important than in wartime.

The American Society of Tool Engineers is, I believe, the youngest of our national engineering and technical societies and is to be congratulated not only on the dignity it has brought to the profession, but also on the information it is constantly making available through data books, monthly publications and technical sessions.

We will do well to encourage our Tool Engineers to be members of this Society, as no one has a monopoly on progress, even on tools and methods. Those of us with many years of experience know that the exchange of ideas, through discussions with engineering, technical, and management groups, and acquaintance with men in similar fields, develops our knowledge and, therefore, makes us more valuable to our individual enterprises.

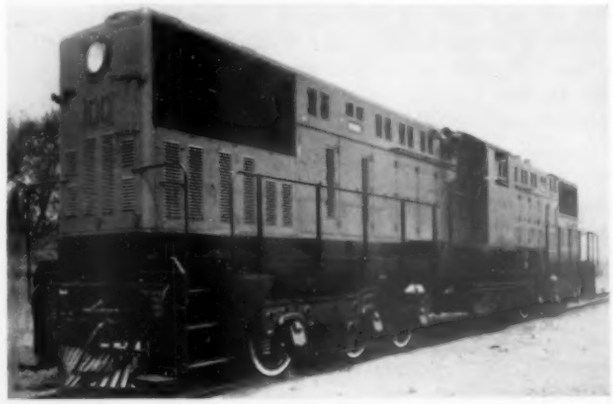
Production is the master key to our whole economy, and the knowledge and experience gained by Tool Engineers, which is available through the American Society of Tool Engineers, is important to those who have chosen this profession. Especially so, if the challenge created by the present conditions and the highly competitive situation in which we will very soon find ourselves is to be met successfully by our individual industrial enterprises.

As we met this challenge successfully in war, by the help of the Tool Engineers, I am confident we can look to the future with courage and with confidence that it will be met successfully in the days that are ahead.

World's Largest

Test runs, of the new Elgin, Joliet & Eastern Railway's 2000 hp diesel-electric transfer locomotive—said to be the world's largest—in which the heaviest load hauled was 3680 tons of freight, indicate that it can replace four standard Mikado-type steam locomotives as now used in the Chicago Outer Belt Line service. The engine has a maximum speed restriction of 60 mph, but was designed for high, continuous tractive service at slower operating speeds.

Besides its great power, the new Baldwin-Westinghouse locomotive has several novel features. Twelve wheels, mounted on two trucks, are driven by six motors powered by two Baldwin 8 cylinder, 4 cycle diesels of 1000 hp each. The control is said to be the simplest ever put into a locomotive, eliminating all transition. There is only one throttle and no "shifting of gears." Also, a center cab, with controls on each side, obviates turning the locomotive.



By Henry J. Barten

Standardization of Gages

Continued Cooperation Between Industry and Government Held Essential to Refinement of Measurement Standards

WORLD WAR II PLACED a very great strain upon the manufacturers of precision gages. Gage-makers are to be commended, however, for the performance of one of the many miracles of modern production that was enacted in this country during the last few years. There is no doubt that this miracle was largely due to the standardization of measuring equipment. There was, however, some confusion due to faulty engineering standards.

It is a well known fact that when a manufacturer produces a part for his own use, he may use whatever standard he sees fit. This principle has been applied by the great automobile industries in this country. But, when he produces components which are to be interchangeably assembled, with components which are manufactured by other concerns, trouble is bound to occur unless standards are agreed upon beforehand.

Henry J. Barten **attended the Baltimore Polytechnic Institute, Baltimore. Upon graduating, he started serving an apprenticeship with the Crown, Cork and Seal Co., in the meanwhile taking evening courses in engineering at Johns Hopkins University, from which he was graduated with degree B.S., in mechanical engineering.**

After serving as a machinist at the Edgewood Arsenal and the Washington Navy Yard Optical Shop, from which he was transferred (in 1942) to the Gage Div'n of the Navy Department, he joined the Armour Research Foundation, early in '46, as Ass't Engineer. He is a member of A.S.M.E., the Mathematical Ass'n of America, the Army Ordnance Ass'n and of Chicago Chapter, A.S.T.E.

The Navy Department was in a position to observe the sometimes chaotic results due to the failure of some manufacturers to interpret gage drawings correctly and, also, due to the failure of certain design departments to make drawings so that they could always be correctly interpreted. Additionally, toward the middle of World War II, manufacturers and design departments were faced with a critical manpower shortage, as a result of which occasional slips went by undetected until after the manufacture of the gage, at which time it was too late.

Since the Navy Department did not manufacture many of these gages themselves, but contracted the work to a large number of manufacturers, it was impossible to educate "greenhorn" war plants overnight. Self-confidence frequently overcame caution and some of these plants misinterpreted details on drawings which, in turn, caused a lot of grief, expense, and bad feelings. If they had been previously educated to interpret these drawings correctly things would have been different. This was a case of misunderstanding, on the part of certain industrial groups, of government standards.

Two examples of this occurred in the Navy Gage Division. The term "first perfect thread" was used quite often on certain types of thread gages. Before continuing with the function of this type of gage let us look to shop practice in the tapping of holes. When a hole is tapped to a specified depth, the first full thread on the tap determines the effective depth no matter how the leading part of the tap is ground. In order to insure that the head of the component screw is properly seated before the first thread jams in the tapped hole, it is necessary to place a tolerance on the dimension from the center of the first thread on the gage to the head of the gage.

Three Answers, All Different

The whole trouble began when it was asked just where the first perfect thread began. There were three different answers to this question. (1) The gage was placed in an optical comparator and rotated until the convolution profile disappeared and the major diameter started to show. The distance from the center of this thread to the head of the gage was then measured. (2) The hair-line of the comparator was set on the minimum nut line and the gage was rotated until the leading flank of the first thread was completely full above the hairline. The distance from the center of this thread was then measured.

(3) The hairline of the comparator was set on the full depth line and the gage was rotated until the leading flank of the first thread was completely full above the hairline. The distance from the center of this thread to the head was then measured.

The three interpretations, thus arrived at, indicated differences of .025", for dimensions whose tolerances were .001"! One may therefore conclude that if any one of these interpretations had been standardized there would not have been so much confusion and loss of time and money.

The second example occurred when a prominent gear manufacturer, assigned to the making of a set of gear tooth gages, was presented with a drawing which showed a radial dimension from the intersection of the pitch chord and the gear tooth profile to the outside diameter of the gear tooth. The manufacturer interpreted this dimension as being the corrected addendum and caused errors of .0006", where .0002" tolerances were involved. In this case, the designer and manufacturer were both at fault because the drawing had all the necessary information on it but it was presented in such a way that the addendum correction was overlooked.

Definite Program Needed

In this connection, another interesting fact was brought out during the war years. Many gage contractors went ahead with the manufacture of gages without even attempting to observe the inspection methods which were used as a final check by the Government on all types of gages. Only after the gages had been rejected did these contractors send representatives to observe the techniques. Most of the contractors who sent representatives beforehand had very little trouble. This means that a definite program, which will make American gage-conscious, should be inaugurated immediately.

The Navy Department is doing something about this problem, and is now setting up a series of gage laboratories in the leading universities in this country with the object of helping industry and to train prospective inspection experts. This program is all right insofar as precision measurements are concerned. However, industry and schools must be trained so that their interpretations of gage drawings are identical, and this seems to call for a further refinement of the present program.

There is no doubt, in the event of another war, that gages will play a dominant part and that the design sections of the Government will be well separated from the manufacturers of precision gages as has been the case in the past. If industry and schools are trained so that they can immediately understand just what the current Government departments want when they ask for a gage, it would seem that the problem would be considerably simplified if not entirely solved.

This, however, is not the case. Plans should be made so that changes in administrative, engineering, and inspection personnel in Government and industrial gage circles will not change the interpretation of small and seemingly trivial details which are now involved in gage design. This means that more of such details should be put in writing and be distributed so that another emergency will find everyone concerned with gages fully prepared. This is the only way to get an effective nation-wide gage supply in a minimum of time.

The gage problem in World War II, however, was definitely better than that of World War I. This was due to what progress has already been made in the standardization of measurements. This standardization has just about reached an optimum, however, and it is now necessary to refine it.

From now on, Government and industry must meet each other half-way in relation to the exchange of ideas on the functioning of gages, and in a concentration on the meaning of details which to some manufacturing groups have seemed so unimportant. If another war should come, industry will have to adhere to standards, set up through cooperative Government and industrial effort, and not be forced to follow the whims or fancies of individual designers.

A Correction

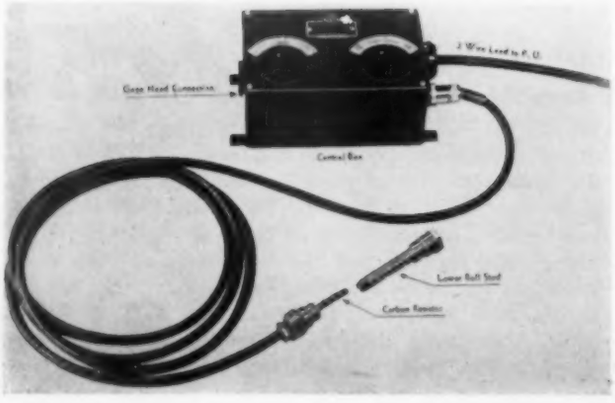
As one of those things, an unfortunate error occurred in the presentation of Pratt & Whitney gages in the article "Gages and Testing Equipment," page 23, August, *The Tool Engineer*. Without going into reasons for the lapse, we repeat two of the photographs previously used, with corrected description. We also show supplementary photos, with explanation of application.

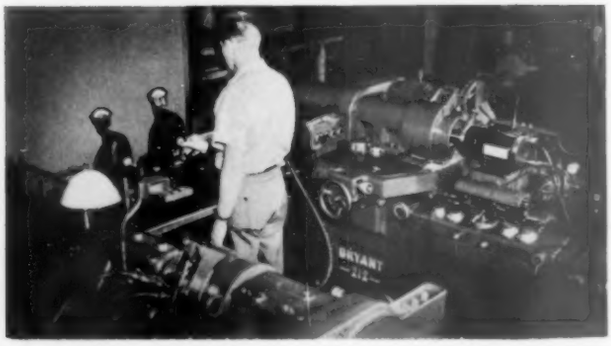
At top left, below, is the Pratt & Whitney Model D-10 Electrolimit Continuous Gage or "flying mike," which is applied to continuous rolling mills or inspection lines for checking the thickness of strip. The deep throat permits the gaging rolls to reach farther than is possible with standard gages.

At top right, below, is the P & W Model C 6 DOU Electrolimit External Comparator, used as a working gage for the inspection of parts at the machine, also, as an inspection gage for checking production parts in receiving and final inspection departments. At bottom, left, is the P & W Temperature Compensator, designed for use with any Pratt & Whitney continuous gage to maintain zero setting for all conditions of temperature.

At top, right hand column, is the P & W Model E Air-O-Limit Comparator, primarily designed to meet the requirements of the Bearing Industry, where utmost consideration must be given to *speed, accuracy, dependability and service*.

At bottom right is shown the two Pratt & Whitney Model E Electrolimit Internal Comparators being used by the operator to check both the large and small ends of refrigerator connecting rods as produced on a Bryant High Speed Grinder. These gages are checking size, roundness and taper to "split tenths" and are used in conjunction with statistical quality control charts.





By Anders Jansson

Fellows Introduces New Lead Measuring Instrument

Wide Range of Application and Electrical Recording Feature Versatile Gear Checker

ADDED TO THE LIST of precision tools for gear checking is the new No. 12H Lead Measuring Instrument, a recent development of the Fellows Gear Shaper Company, Springfield, Vt., and now available to industry.

Operating on a basic principle, the instrument incorporates an arrangement whereby the lead of helix is checked by the continuous motion of a measuring pointer in conjunction with the desired rotation of the work. For example, if the work being checked is of the correct lead, the dial indicator remains stationary; however, if there is an error in lead, the indicator will show—in 0.0001 of an inch—the displacement of the helix in the face width being measured.

The principle embodies two tangent bars and pins, both of which operate slides, the one effecting the traverse movement of the member carrying the measuring pointer and the other the rotation of the work. Contact positions of the pins on the tangent bars are set by means of micrometers and precision gage blocks, and dial indicators are provided so that the setting pressure can, at all times, be accurately maintained. Errors in gears can be checked by using the dial indicator carried on the measuring slide, or, a chart can be produced which may be used as a permanent record.

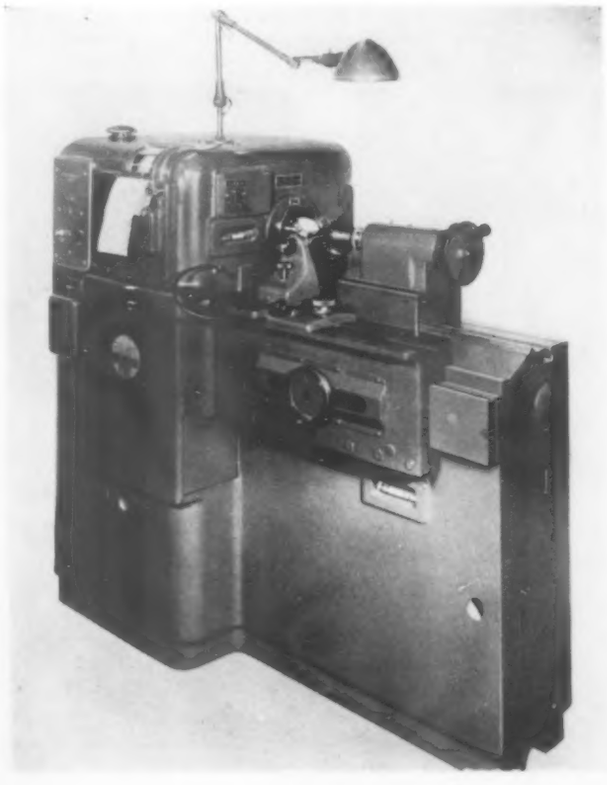
An electric recorder, incorporated as an integral part of the instrument, automatically produces a record of the displacement of a tooth face on a ruled paper chart. This chart is provided with ruled lines running parallel with the length of the paper ribbon. The heavy ruled lines are ½" apart and represent a 0.001-inch movement of the measuring pointer. Semi-circular lines—corresponding in radius to the sweep of the stylus—are also ½" apart, and these represent 0.200 inch on the face width of the gear. From this brief description, it will be seen that a gear one inch in face width would be represented by five spaces on the chart (5 x .200 = 1 inch), or 2½ inches. The amplification, then, is 2½ : 1.

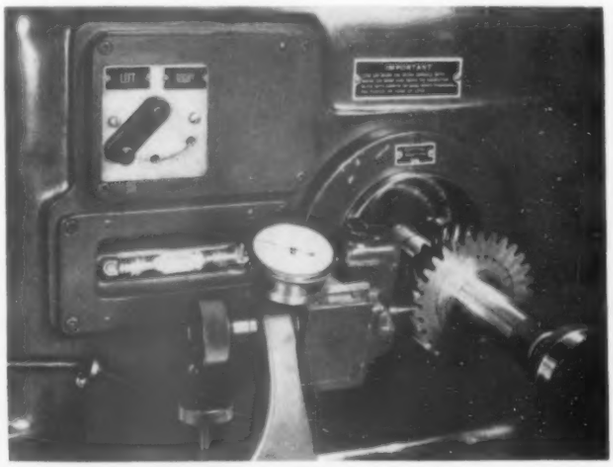
Since the ½" spacing of the longitudinal lines represent .001", and are divided into five divisions (light rulings), errors in helix are clearly indicated to .0002". In other words, amplification is 500 to 1, making for extremely accurate analysis of variations together with a permanent recording.

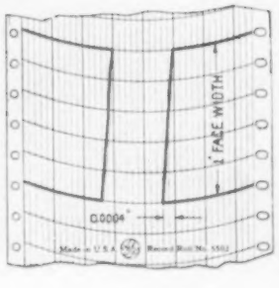
Contact points of the pins, on the tangent bars, are independently adjustable, making possible a traverse of the measuring pointer without rotation of the work, and vice versa. This greatly increases the range of the instrument since, in addition to checking the lead of helical gears, it can also be conveniently used for checking the taper and crowning of spur and helical gear teeth.

The Fellows No. 12H Lead Measuring Instrument, with Recorder, is shown in Fig. 1, with the close-up view as it is applied to the checking of a right hand helical gear. Fig. 3 is a close-up of the Electric Recorder, and Fig. 4 (extreme lower right) is a section of a chart of adjacent sides of a right hand helical gear tooth showing the gear measured has 0.0004 inch displacement in helix in the face width measured. As recorded, a short lead is indicated.

FIG. 1, below; FIG. 2, at right; FIGS. 3 and 4, left to right, at extreme lower right.







By Fred W. Steiner

Boring and Facing Head Speeds Production

New G & L Attachments Increase Range and Versatility of Horizontal Boring Machines

A VARIETY of machining operations—as boring, turning, grooving, facing, recessing and threading — usually difficult to handle on standard equipment, are considerably simplified by a continuous feed Facing and Boring Head manufactured by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wisconsin.

While the design embodies principles long proven in practice, and which enhance its value, it is engineered throughout and incorporates refinements and improvements, including continuous feed, which suit it to the machining of cumbersome workpieces which cannot be readily reset.

Attachment may be mounted direct, on the spindle sleeve of a Giddings & Lewis horizontal boring machine, or, with a suitable adaptor, on a line boring bar. When placed on the headstock, the machine spindle extends through the head of the unit and may then be operated independently or simultaneously with the head. Such combining of operations reduces set-up time, broadens the range of operations and, as a consequence, profitably reduces overall production time.

The unit is precision made throughout, with all bearing surfaces hand scraped. Milled Tee-slots, in the cross slide, facilitate mounting of cutting tool holders. Actuated by a precision feed worm, with a micrometer dial to register the amount of feed, the tool slide feeds in either direction. Dial is graduated in increments representing .001" travel of the tool slide.

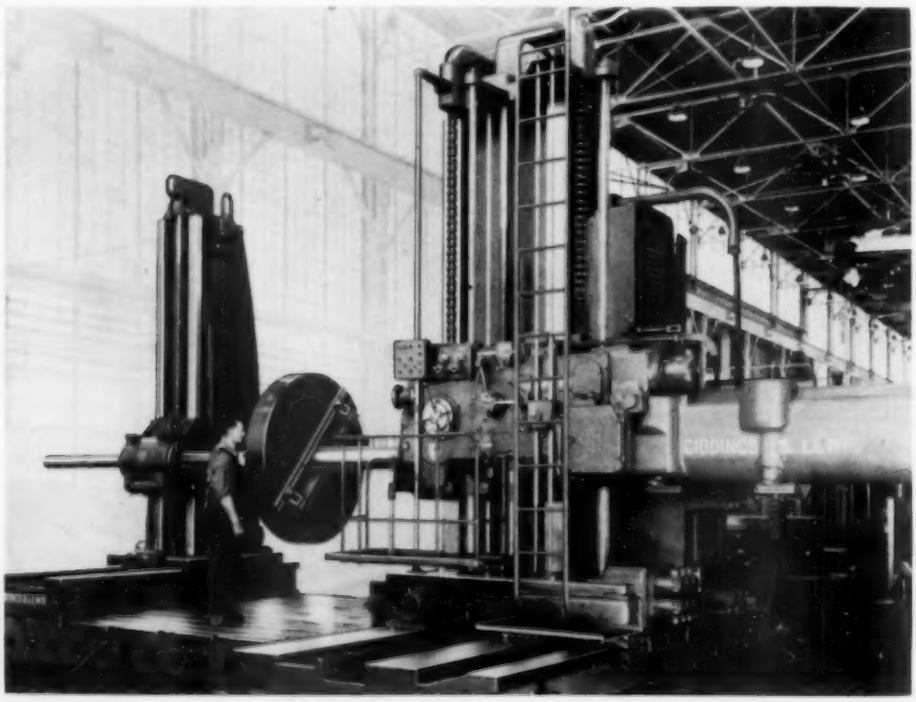
Six separate power feeds, arranged in geometrical progression, are readily available through a simple manual selector. One complete turn of the dial moves the tool slide ¼"; however, the tool slide may be independently positioned, through the precision worm, by means of a hand crank.

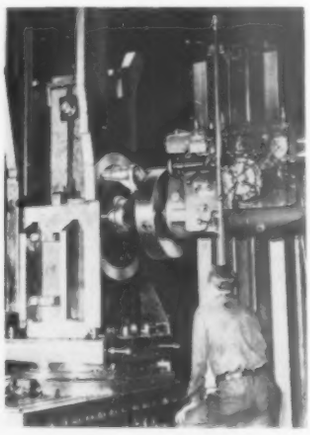
In addition to the power feeds of the attachment, the machine spindle extends through the head and operates independently. Hence, spindle and head feeds may be obtained simultaneously or independently, as desired; in the former case, boring and facing operations may be carried on at the same time.

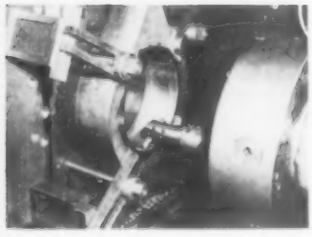
As typical applications, the attachment may be used for large open or blind holes beyond the range of standard boring tools; for trunnion, stud or similar turning operations; for the internal machining of forging dies, and for internal and external grinding operations by means of a special grinder mounted on the tool slide. It may also be used to machine two sides (or ends) of a workpiece simultaneously, in which case two continuous feed facing heads are used, one mounted on the boring bar and the other on the machine spindle sleeve.

An excellent idea of the range and versatility of the attachment may be obtained from the several illustrations. A particularly interesting application is the threading of an engine connecting rod, a workpiece obviously too large to swing in a lathe. That a part of this nature can be successfully threaded, to precision requirements, is "proof of the pudding" as far as the versatility of the attachment is concerned. These continuous feed facing heads are available in sizes ranging from 17" to 60" in diameter, with facing diameter up to 96" for the 60-inch head.

Below, Continuous Feed Facing Head mounted on the boring bar of a floor type Giddings & Lewis Horizontal Boring Machine. At right, upper photo threading the end of a marine engine connecting rod with a Continuous Feed Facing Head. Micrometer feed dial is manually adjusted for depth of cut. At lower right, the Facing Head used on an interrupted facing cut. The trunnion shown on the part has just been turned.







A.S.T.E. NEWS

NEWS OF INTEREST AND ABOUT MEMBERS

Three National ASTE Committees inaugurate programs in recent organizational meetings. Above, Public Relations Committee (seated left to right): W. J. Gamble, H. H. Whitehall, C. V. Briner, Chmn.; Dr. H. B. Osborn, Jr., Vice-Chmn.; and J. M. Cannon, Public Relations Counsel. Standing: S. H. Grattan, R. E. Crawford, H. E. Campbell and W. W. Young. Top right, Membership Committee (seated left to right): H. F. Volz, Vice-Chmn.; E. W. Dickett, Chmn.; Edythe Reichart, Secy. to Committee; H. A. Bachman, F. J. Dawless and H. D. Mozeen. Standing: I. F. Holland, 3rd Vice-Pres.; and C. J. Lindegren. Below, Editorial Committee (left to right): K. C. Jasper, M. J. Radecki, F. C. Koehn, Maxsine Erickson, meeting secy.; W. B. Peirce, 1st Vice-Pres.; W. B. McClellan, Chmn.

National Committees Meet to Make Recommendations

Board of Directors to Consider Proposals

INITIATION OF long-range programs and the drafting of recommendations for consideration by the Board of Directors during its Semi-Annual Meeting at Pittsburgh, October 11-12, marked the recent organizational meetings of several National ASTE Committees.

First of a series of three preconvention conferences took place August 17-18-19 when C. V. Briner, National Public Relations Chairman, called his Committee together at Hotel Pennsylvania, New York City.

Dr. Harry B. Osborn, Jr., Director of Research, Ohio Crankshaft Co., Cleveland, Ohio, was elected Vice-Chairman of the Committee, and John M. Cannon, Public Relations Counsel attached to the Central Office staff, was named Secretary to the Committee.

Public relations phases of the Society's expositions and conventions and suggestions for future policy in that connection were among major subjects discussed at the meeting.

The Committee approved informing the membership of the provisions of the Professional Engineers Act, effective in most of the States; that members register under this Act wherever possible, and that the Society consider the sponsoring of refresher courses and other assistance to enable members to become Registered Professional Engineers.

A series of bulletins to be issued by the Committee to Chapter Public Relations Chairmen will explain how the latter can effectively coordinate their local activities with those of the National group.

Chapters, the Committee agreed, should be requested to publish and distribute to their members annual programs for the entire season.

Continuance and expansion of the current regional meetings were favored by the Committee. Establishment of standards for technical papers presented before the Society was urged.

The Committee also reviewed and formally commented on other Society activities, and prepared a Committee budget for consideration by the Finance Committee.

Press Invited

Highlighting the final day of the meeting was a press reception attended by 134 representatives of leading trade papers, general magazines and newspapers. Chairman Briner outlined the history and objectives of the Society for the assembled editors and news writers and introduced his Committeemen: Dr. H. B. Osborn, Jr. (Cleveland), Harry H. Whitehall (Hamilton), W. W. Young (Boston), Stanley H. Grattan (Detroit), and W. J. Gamble (Buffalo-Niagara Frontier), as well as R. Eric Crawford (Toronto), Editor, *Canadian Machinery & Mfg. News*; and H. E. Campbell (Cincinnati), Vice-President, Editorial,

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Gardner Publications, Inc., both of whom were present in a dual capacity.

Arrangements for the reception were made by Mr. Cannon who was present throughout the meeting.

* * *

Concurrent meetings of the National Editorial and National Membership Committees were held August 24-25 at Hotel Statler, Detroit.

In the Editorial Committee meeting, conducted by W. B. McClellan, Chairman, announcement was made of the appointment of H. L. Tigges, Vice-President and Sales Manager, Baker Bros., Inc., Toledo, Ohio, as a member of the Committee.

The group voted to increase its numbers to at least eight, with a view toward eventual rotation of members; suggested minor revisions in its Committee procedure; and determined policies for its guidance, besides disposing of considerable miscellaneous business. Chairman McClellan was authorized to submit a budget for Committee approval.

States Publishing Aims

President A. M. Sargent, in expressing his views on the Committee's objectives, said: "Your yardstick is news value to 18,000 members, technical value, and getting it there first — correctly, accurately and in detail. Nothing can substitute for the spoken word."

After recessing for luncheon with R. B. Powers, Executive Editor of *The Tool Engineer*, the Committee made a tour of the publication plant before reconvening for the Saturday afternoon session.

Editorial Committeemen attending the meeting, in addition to Chairman McClellan of Detroit, were: Foster C. Koehn (Milwaukee), Michael J. Radecki (New Haven), and Kenneth C. Jasper (Louisville).

Other officers and representatives from the Central Office also present included: W. B. Peirce, First Vice-President; Grant Wilcox, Jr., National Director; H. E. Conrad, Executive Secretary; J. M. Cannon, Public Relations Counsel; C. J. Hasse, Office Manager; and Maxsine Erickson of the ASTE staff, who served as secretary for the meeting.

* * *

Third Vice-President I. F. Holland, as Acting Chairman, called the National Membership Committee to order on August 24, H. F. Volz, Vice-Chairman of the Committee, presiding during the second day of the conference. The two officers acted to relieve Chairman E. W. Dickett who was severely afflicted with hay fever.

Outlines Committee Setup

Mr. Holland discussed the administration's plan to establish a semi-permanent Membership Committee whereby a continuity of thought and action could be effected from year to year.

When asked for his opinion on the functions of the Committee, President Sargent stressed the importance of retaining present members, rather than acquiring new affiliates.

"This Committee must get new members, must retain members, and must revive members," Mr. Sargent asserted.

Mr. Conrad, the Executive Secretary, reported on the operations of the Headquarters staff, and Edythe Reichart, Central Office Secretary to the Membership Committee, outlined in detail the processing of membership applications. The Committee then visited Headquarters to study actual office procedures.

H. E. Bachman of Detroit was appointed a one-man committee to work with the Public Relations Committee in revising the membership brochure.

H. F. Volz, John Lindegren and H. D. Mozeen, acting as a budget sub-committee, submitted an itemized statement of estimated Committee appropriations.

In discussing means of assisting Chapters in obtaining new members, the Committee set a quota of 10% increase in membership as a Chapter goal.

Membership Drive Assignments

Chapters were assigned to the Committeemen, for the membership drive, as follows: H. E. Bachman — Detroit, Toledo, Western Michigan, Windsor, Flint and Pontiac; L. M. Cole—Houston and North Texas; F. J. Dawless—Fairfield County, Hartford, New Haven, Greater New York and Northern New Jersey.

E. W. Dickett — Racine, Milwaukee, Chicago, Twin City, Rockford, South Bend, Fond du Lac and Fox River Valley; J. I. Junkin—Indianapolis, Louisville and Evansville; J. O. Knight—St. Louis, Tri-Cities, Peoria, Decatur, Springfield (Ill.) and Cedar Rapids; C. J. Lindegren — Worcester, Springfield (Mass.), Boston, Twin States, Portland (Me.) and Little Rhody.

E. M. McLernon—Baltimore, Philadelphia, Central Pennsylvania, Potomac and Williamsport; H. D. Mozeen—Buffalo-Niagara Frontier, Rochester, Syracuse, Schenectady, Elmira and Binghamton; M. M. Ross — Kansas City and Wichita; J. M. Rudel—Toronto, Montreal, Lakehead and Niagara District; and H. F. Volz — Dayton, Cincinnati, Columbus, Fort Wayne, Richmond and Muncie.

Adoption of a differential in registration fee, for members and non-members attending national meetings and expositions, was voted by the Committee.

A ruling, that no grade changes be made on applications for membership, without Chapter approval, was also made.

Membership Committeemen attending the meeting were: E. W. Dickett, Chairman, (Rockford); H. F. Volz, Vice-Chairman, (Columbus); H. A. Bachman (Detroit), F. J. Dawless (New Haven), C. J. Lindegren (Worcester) and H. D. Mozeen (Syracuse).

Among others present for the two-day assembly were: V. H. Ericson, National Treasurer; W. A. Dawson, Assistant Secretary-Treasurer; J. M. Cannon, Public Relations Counsel; and C. J. Hasse, Office Manager.

Absent members of the Committee were: L. M. Cole (Houston), J. O. Knight (Peoria), J. I. Junkin (Louisville), E. M. McLernon (Baltimore), M. M. Ross (Wichita), and J. M. Rudel (Montreal).

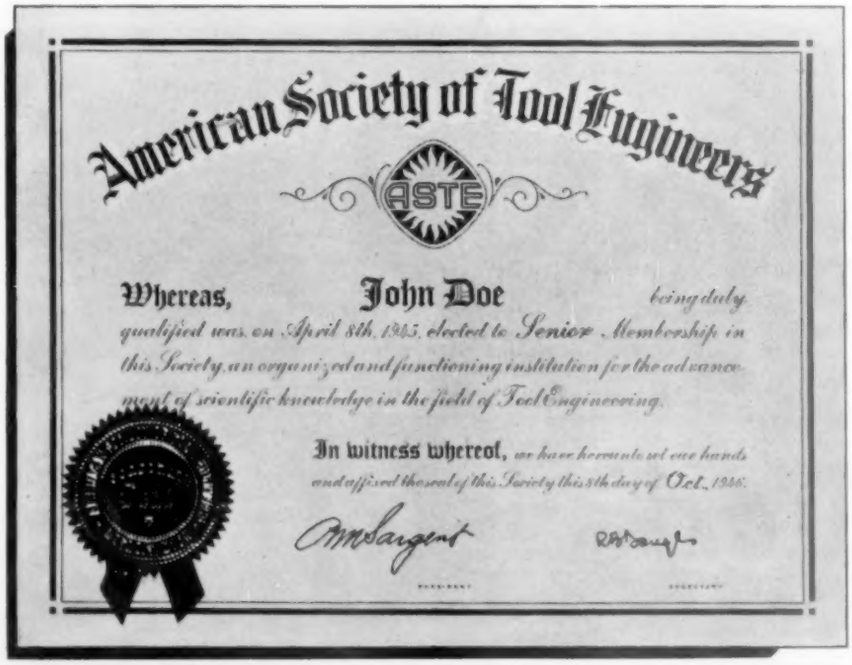
Membership Certificate Welcomed by ASTE'ers

Detroit, Mich. — Immediate response to recent announcement of the availability of the long-projected Society membership certificate indicates the eagerness of ASTE members for documentary evidence of their affiliation with this organization.

The certificate, which is printed in blue and gold, attests to the election and respective grade of membership of the holder. It is signed by the President and National Secretary, and affixed with the corporate seal of the Society. As stated in the Constitution, the certificate remains the property of the Society and is subject to recall. Certificates may be exchanged without charge when members are promoted to more advanced grades of membership.

Issued in convenient size, 10⅞" x 8⅜", the membership statement may be had either framed with a black moulding or unframed.

Members who may not have received order blanks, through recent changes of address, may obtain them upon application to the Central Office.


American Society of Tool Engineers
ASTE
Whereas, John Doe being duly
qualified was on April 8th, 1965, elected to Senior Membership in
this Society, an organized and functioning institution for the advancement of scientific knowledge in the field of Tool Engineering.
In witness whereof, we have hereunto set our hands
and affixed the seal of this Society this 8th day of Oct., 1965.

This membership certificate, size 10⅞" x 8⅜", is available for all grades of membership in the American Society of Tool Engineers. It is printed in blue and gold and furnished framed or unframed.

McGill to Present Films At Pittsburgh Convention

Pittsburgh, Pa. — Donald W. McGill, Machinery Electrification Manager of the Industrial Sales Dept., Westinghouse Electric Corp., E. Pittsburgh, will present the morning film program on the final day of the ASTE Semi-Annual Meeting at Pittsburgh, Saturday, October 12.

D. W. McGill

Mr. McGill will comment on the five Westinghouse motion pictures to be screened. Two of these showings will be world premieres of new film productions.

A detailed time schedule of this and the motion picture programs for Thursday and Friday appears on this page.

With his company since 1933, Mr. McGill has filled assignments in the Steel Mill and Metal Working Section, handling steel mill auxiliaries, automotive industry, heat treating, welding and aluminum companies and induction heating activities, before transferring to Machinery Electrification three years ago.

For four years he has headed the annual Westinghouse Machine Tool Electrification Forum. His B.S. in E.E. was conferred by Penn State College where he was a member of the Honor Council and of several fraternities.

Technical Film Schedule
Pittsburgh Convention

Thursday, October 10

9:30 A.M.	"Micro-Instrument Ball Bearings, Their Care and Handling"
9:55 A.M.	"An American Miracle" (Setup and operations for balanced mass production)
10:15 A.M.	"Basic Principles of Lubrication"
10:40 A.M.	"To New Horizons" (World's Fair G.M. Exhibit)
11:05 A.M.	"Quality in the Making" (Ball bearing manufacture)
11:30 A.M.	"Progress Through Engineering" (Relationship of modern civilization to engineering)
11:50 A.M.	"Precisely So" (Measuring standards)

Friday, October 11

9:30 A.M.	"When Can You Measure" (Electrical measuring instruments)
10:10 A.M.	"Exploring with X-Ray" (Discovery and development of X-ray)
10:50 A.M.	"Railroadin'" (Saga of rail transportation)
11:20 A.M.	"West Lynn" (Watt-hour meter)

Saturday, October 12

9:30 A.M.	"Dawn of Better Living" (Electric home equipment)
9:50 A.M.	"Summer Storm" (Electric power system service)
10:15 A.M.	"Radio Frequency Heating" (World Premiere)
10:45 A.M.	"Magnetic Contactor Tests" (World Premiere)
11:20 A.M.	"On the Air" (History of radio broadcasting)

Flanders Wins Nomination For U. S. Senate

Springfield, Vt. — Ralph E. Flanders, President of Jones & Lamson Machine Co. and a national influence in many fields, added new laurels with his recent victory in the Vermont primaries for U. S. Senator.

R. E. Flanders

His election, as Republican candidate from the strongly G.O.P. State, would make him successor to Warren R. Austin who resigned to become permanent U. S. member of the United Nations Security Council.

In his first campaign, six years ago, Mr. Flanders lost the nomination to Senator George Aiken, but in the current contest he won both rural and urban vote from Sterry R. Waterman, Attorney, with the comfortable majority of 30,878-24,823.

For the past dozen or so years, the engineer-industrialist has been a familiar figure in the nation's capital, through his association with NRA, OPM, WPB, CED, the Economic Stabilization Board, Department of Commerce and other agencies.

Recently he retired from the presidency of the Federal Reserve Bank of Boston, but he still retains a multitude of business, civic and professional activities.

A member of Twin States Chapter, ASTE, Mr. Flanders addressed the Society's Annual Meeting in Cleveland last April. His paper was included in the "Tool Engineering and Profits" symposium published in the September issue of *The Tool Engineer*.

Da Vinci Early Student Of Motion and Time Study

Minneapolis, Minn. — "Principles of Motion and Time Economy Applied to Tool Engineering" was the subject of the technical session at the first fall dinner meeting of Twin City Chapter, held September 4 in the Covered Wagon Cafe.

Dr. Derso Shybekay

Dr. Derso Shybekay, Vice-President of the Industrial Research Council, Director of Market Research for the North Star Woolen Mill Co., Minneapolis, and a Chapter member, was the speaker. He prefaced his talk with a brief history of time and motion study, tracing it from the time of Leonardo da Vinci. This famous painter, he added, was also skilled in the art of bricklaying. Using the principles of motion and time study, he continued, da Vinci advanced the completion date of a large highway project under construction at that time.

The speaker then recounted the trials of advocates of motion and time standards during the turn of the nineteenth century, because of their improper concept and use of the subject.

Until recent years, Dr. Shybekay pointed out, the statute books contained restrictions governing motion and time standards in the shipbuilding industry. The new standards accepted by both industry and labor were in large measure those formulated and advocated by Dr. Shybekay and his associates.

The group was warned that much harm is being done in this field by so-called "professional" and "tool" engineers who fail to give proper consideration and thought to the application of time and motion economy. Thus, when the informed time study engineer is given the task of completing a bungled program, he lacks the co-operation of both management and labor, the speaker observed.

Dr. Shybekay concluded his talk with an excellent question and answer session, the audience indicating by vigorous applause its approval of his presentation.

In the absence of Chairman John Harrington, First Vice-Chairman Clifford Lofdahl conducted the preceding business meeting. During the evening 15 guests were introduced to the membership.

A tribute to the late George W. Wise, Past Chairman and charter member of Twin City Chapter, given by Kenneth Roby, summarized the Chapter's loss of this capable leader.

William Boker, a former Chapter Chairman, presented a Past Chairman pin to Wallace Ahlberg who headed the Chapter during the 1945-46 term.

Municipal Committee Handles Labor Problems

Toledo, Ohio—Attorney Michael V. DiSalle, Vice-Mayor of Toledo and founder of the Toledo Labor-Management-Citizens Committee, addressed the September 11 meeting of Toledo Chapter at the Commodore Perry Hotel.

Mr. DiSalle's subject was "Toledo—Pioneers for Peace." The organization and operation of the unique local committee for preventing as well as settling labor disputes and the formation of an Industrial Relations Charter were discussed in detail by the speaker.

An audience of 117 attended the dinner meeting.

Human Body Produces Many Drugs, Jones Says

Rockford, Ill. — Approximately 125 members and their guests attended the September 5 meeting of Rockford Chapter to hear Dr. Hilton Ira Jones of the Hizone Laboratory, Wilmette, Ill., talk on "A Study in Self-Management." The dinner meeting, first of the new season, was held at the Faust Hotel.

Dr. H. I. Jones

Dr. Jones' lecture dealt with the chemical functions of the human body and how they maintain the proper safeguards to insure a high, healthy physical efficiency.

In this, his third appearance before the Chapter, Dr. Jones explained that the human body has 22 chemical factories producing drugs that are manufactured commercially.

Volkenant Depicts Electronic Future

Chicago, Ill. — The amazing "push button" future in store for us was revealed by Gordon Volkenant, Co-ordinator of New Products Research, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., speaking at the opening meeting of Chicago Chapter, held September 3 in the Furniture Club of America.

In "Electronics Explained," the 178 members and guests learned from Mr. Volkenant how top-secret devices employed by our armed forces are being converted to peacetime uses.

With his faculty for presenting highly technical data in layman's language, the speaker told how giant bombers are lifted from the ground by effortless fingertip control.

In his two-hour address which held the undivided attention of his audience, Mr. Volkenant also related the role played by radio-controlled aircraft in the smashing of the Axis.

Film Flashes

"A Story of Texas and Its Natural Resources"—The mineral wealth of the Lone Star State, as well as its scenic beauty, agriculture, cattle raising, transportation, and modern industries, are portrayed in this first Bureau of Mines film depicting the natural resources of an entire State.

Part I of the new picture is devoted entirely to mineral industries, including exploratory operations in tapping the vast petroleum resources, the drilling of wells on land and off-shore, the processing of oil in great refineries, and its transportation by pipeline, tank car and ocean tanker. There are also scenes showing the manufacture of synthetic rubber, as well as natural gas production, and the extraction and processing of helium, the modern miracle gas.

From petroleum, the film turns to operations in other mineral industries of Texas, such as tin, lead, copper, and magnesium. Of special interest is the sequence showing the extraction of magnesium from sea water.

Sulphur Production Sequences

Texas' world leadership in the production of sulphur and the ingenious method by which this mineral is extracted from the earth provide the subject for another interesting section of the new film. Equally absorbing are scenes showing the processing of salt, granite, clays, carbon black, limestone, graphite, gypsum, silica sands, in addition to coal mining and steel-making operations.

Part II brings to the screen water and power developments; timber resources, logging and paper industries; wheat, cotton and rice growing; and cattle ranching. In this part of the film are shown some of the thriving and progressive Texas cities, such as Houston, Dallas, Fort Worth, San Antonio, Galveston, Austin and Amarillo.

The 16 mm. sound production has a total running time of 57 minutes. Applications for free loans of the film should be addressed to the Graphic Services Section, Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Pa.

Diamond Appointed Representative

Philadelphia, Pa.—Arthur R. Diamond formerly Design Engineer for Edward G. Budd Mfg. Co., has been named Special Representative by Jackson Associates, manufacturers' representatives and engineers with offices in Philadelphia, New York, Newark and Baltimore.

A. R. Diamond

Mr. Diamond joins the organization as a capable engineer, educated at the University of Pennsylvania. His professional experience includes positions with Kellett Aircraft, Roberts & Mander Co., and L. Berry & Co.

In addition to his office of First Vice-Chairman, Philadelphia Chapter, ASTE, he holds memberships in ASME, SAME and ASM.

New Sample Data Sheet To Aid Suppliers

Detroit, Mich.—A new sample ASTE Data Sheet, developed by the Data Sheet Sub-Committee, has been issued by the National Standards Committee to each Chapter Standards Chairman. The specimen sheet is intended as a guide to Chapter Standards Committees and prospective Data Sheet suppliers in the preparation of official ASTE engineering data.

Conformance with the mechanical requirements, apparent in the sample, will assure uniformity in size, arrangement, margin, paper stock, typography, punching, classification number, item and company name, and all other elements in the specific format of the Society's Data Sheets.

While most of these particulars are contained in the text of the ASTE Tool Engineering Data Sheet Specifications, the National Standards Committee feels that checking with an actual sample will facilitate Data Sheet preparation.

Chicago Members Examine Electronic Automatic Controls

Keen interest in the electronic devices shown by Gordon Volkenant, of Minneapolis-Honeywell Regulator Co., is evident as Chicago Chapter members crowd around display accompanying Mr. Volkenant's lecture, "Electronics Explained." Behind table in photo at left are: Clare Bryan, Chapter Chairman; (second man unidentified), Sven Goransen, Past Chairman; Mr. Volkenant and Fred J. Schmitt, First Vice-Chairman. Audience of 178 attended lecture.

Buffalo Members Wind Up Summer Season with Stag Party

Closing event of the summer season for Buffalo-Niagara Frontier Chapter was the Annual Stag Outing held August 10 at Cook's Paradise Grove between Buffalo and Lockport, N. Y. A picnic and program of sports activities highlighted the day of recreation. Prizes were awarded to winners of the various competitions. Committee responsible for the successful outing was composed of (left to right): Picnic Chairman Carl Maute, 2nd Vice-Chairman of the Chapter; Martin Kotarba, Chapter Chairman; Garrett Kingston, "Hank" Wild, and Stewart Hudson.

Flushed with victory are soft ball champions (left to right): Wilbur Thompson, (second man unidentified), Bill Thomas, Ed Scholkraft, Ken Kirchner, Johnny Farrell, Bob Thornton, Karl Dibble, Johnny Kirch and Herb Rebman. Perfect weather favored the Buffalo tool engineers for their annual pilgrimage to the picnic resort.

Program Personalities

Roger F. Waindle, General Manager of Sapphire Products Div., Elgin National Watch Co., Aurora, Ill., is currently available to address ASTE Chapters on the subject, "Sapphire — An Engineering Material."

R. F. Waindle

Mr. Waindle's discussion includes a comparison of synthetic and natural mined sapphire; description of the manufacture of sapphire; importance of orientation of the crystal in design; geometry of fabrication from an irregular raw material shape; and methods and machines used in fabricating the jewel.

He shows and explains charts on hardness comparisons, physical and chemical properties, and comparative wear resistance in gage applications, giving details of sapphire plug and ring gages, contact points, tipped micrometers and boring and burnish-cutting tools.

A 16mm, 35 minute, sound and color film, "The Manufacture of Jewel Bearings," and slides supplement the 30-40 minute talk.

Before joining his present company in 1944, Mr. Waindle was employed for several months as General Manager-Chief Engineer at Alloy Casting Co., Champaign, Ill. Earlier in the war he was Chief of Tank Automotive Production, Ordnance Dept., Army Service Forces, in Chicago.

Prior to this he was associated with Fahralloy Co., Harvey, Ill., as Manager of Engineering and Sales, and with The Hoskins Mfg. Co., Detroit, as Sales Engineer.

A native of Madison, Wis., Mr. Waindle graduated with a B.S. in M.E. from Armour Institute of Engineering at Chicago. He is a member of Tau Beta Pi, Pi Tau Sigma and Triangle engineering fraternities, ASM, SAME, Army Ordnance Association, Engineering Society of Detroit, and a charter member of Fox River Valley Chapter, ASTE, where he is serving as Chairman of the Constitution and By-Laws Committee.

Mr. Waindle can accept invitations from ASTE Chapters in the following cities: Akron, Cincinnati, Cleveland, Dayton and Toledo, Ohio; Atlanta, Ga.; St. Charles, Chicago, Rockford and Moline, Ill.; Baltimore, Md.; Binghamton, Buffalo, Rochester and New York City, N. Y.; Boston, Mass.; Bridgeport, Hartford and New Haven, Conn.; Dallas, Texas; Detroit and Flint, Mich.; Indianapolis, Muncie and South Bend, Ind.; Kansas City and St. Louis, Mo.; Los Angeles and San Francisco, Calif.; Milwaukee, Wis.; Montreal, Que.; Newark, N. J.; Philadelphia and Pittsburgh, Penna.; and Minneapolis, Minn.

Good Press Dies Effect Savings, Safety

Williamsport, Pa.—The importance of good design in securing maximum production and safety for the operator was stressed by J. I. Karash, Production and Process Engineer, Reliance Electric & Engineering Co., Cleveland, Ohio, in his discussion, "Design of Dies for Inclinable Punch Presses," before a dinner meeting of Williamsport Chapter, September 9, at the Home Dairy Co.

J. I. Karash

Mr. Karash defined basic differences in the design of dies for inclinable punch presses and for upright punch presses, showing that the inclinable press can be a source of economy with perfect safety, when properly designed dies are used.

A frequent contributor to technical trade papers and the author of "Analysis of Drill Jig Design," Mr. Karash is a Past Chairman of Cleveland Chapter.

Following the dinner, a musical program was presented by the Marionettes, a female sextette.

Chairman J. L. Strasburg presided over the brief business session prior to the technical feature. Program Chairman Lewis H. Bardes introduced Mr. Karash and conducted the technical program.

National Metal Congress, Exposition Announced

Atlantic City, N. J.—The 28th annual National Metal Congress and Exposition will be held November 18-22 at Atlantic City's Municipal Auditorium.

Several hundred exhibitors will participate in the five-day event sponsored by the American Society for Metals, the Iron and Steel Div. and the Institute of Metals Div. of the American Institute of Mining and Metallurgical Engineers; the American Welding Society, and the American Industrial Radium and X-Ray Society. Concurrently with the Exposition, these organizations will convene for their annual meetings.

Many advancements in production and manufacturing techniques will be shown at the Exposition, while timely technical programs will be presented by the cooperating societies.

Explains Tool, Die Work For Fuses and Timepieces

Decatur, Ill.—J. Robert Moore, Secretary, Moore Special Tool Co., Inc., Bridgeport, Conn., was the principal speaker at the technical session following the dinner and business meeting held September 9 by Decatur Chapter, in the Decatur Club.

J. R. Moore

Over 40 members and guests learned of the problems in tool designing and manufacture of anti-aircraft shell fuses and in die work for clocks and watches.

During the course of his talk, Mr. Moore presented several blueprint charts, sample punched parts for fuses, and a completely-assembled fuse. A question and answer period closed the meeting.

In announcing the outstanding meeting for October 14, sponsored by Jack & Heintz, Inc., C. Elmer White, Chairman of the Chapter, indicated that a record audience is expected.

A·S·T·E· Productioneers

YOUR CENTRAL OFFICE STAFF

LINKING THE National Society to its individual Chapters in their common aim of disseminating technical information is the service rendered by Dorothy Meyer, Secretary to the National Program Committee.

Dorothy Meyer, Secretary to the National Program Committee, ponders selection of suitable Chapter speakers in response to a request.

Hers is the responsibility for securing the Chapter speakers listed in the annual Speakers Directory issued by the National Program Committee, as well as new technical films available to ASTE Chapters.

Miss Meyer studies the candid comments concerning Chapter programs, contained in the factual report forms filled in by Chapter Secretaries. This information, when tabulated, constitutes a Society poll on the merits of the various speakers' presentations.

She checks Chapter meeting notices and pores over contemporary technical magazines for news of speakers discussing tool engineering subjects before other societies. Those whose lectures seem to be of the caliber demanded by ASTE audiences are contacted with an inquiry as to their availability.

Develops Itineraries

If the speaker indicates a desire to cover the ASTE National circuit or a specific geographical area during a given time, Dorothy writes to the Chapters concerned in an endeavor to work out an itinerary for the speaker. Needless to say this service is mutually appreciated.

Several files are maintained with data compiled from the various sources. With this cross-indexed material at her fingertips, Dorothy can answer Chapter requests for suggested speakers.

A similar routine is followed in keeping an up-to-date library of film information.

In addition to these duties, Miss Meyer handles the meeting minutes received from the Society's 73 Chapters. She reads each report, bringing to the attention of the Executive Secretary items of especial interest. The minutes are then filed in the corporate record books of the respective Chapters, sometimes requiring retyping if the Chapters neglect to submit them on minute book paper.

An essential detail of this activity consists in following up on missing meeting minutes in order that the organization's archives may be complete as stipulated in the State of Michigan laws under which the Society is incorporated.

Worked in Other Departments

Since coming to the Society late in 1942, Miss Meyer has been well schooled in ASTE work. She has served in the Address Change department and as typist and secretary in several departments. During the recent installation of the mechanical accounting system, she became the office champion on the key punch machine.

Before joining the ASTE staff, she was employed at Weil & Co. furniture store in Detroit. Earlier, she divided her efforts between a part-time position at Detwiler Memorial Hospital in Wauseon and her farm home near Napoleon, Ohio, where she assisted her family. She is a graduate of the Liberty Center (Ohio) High School, class of 1941.

Having no slight skill as a dressmaker, Dorothy makes many parts of her wardrobe each season and still finds time to bowl, swim, play the piano, and sing in the choir of Holy Cross Lutheran Church. During the war she was a faithful USO worker.

* * *

Another important operation at the Detroit office, centers around Stanley F. Girard, Secretary to the National Standards Committee.

Checking proposed ASTE Data Sheets for compliance with Society specifications is one of the many duties assigned to Stanley Girard, Secretary to the National Standards Committee.

While Mr. Girard's day is an extremely busy one, carrying out the ever-expanding program of the National Standards Committee, it doesn't always end at 5 o'clock for he attends the weekly meetings of the Data Sheet Sub-Committee, as well as the monthly sessions of the National Standards Committee, preparing both agenda and minutes.

All of the detail involved in issuing approved ASTE Data Sheets passes over Stan's desk. When the preliminary arrangements are out of the way and the proposed sheet is submitted for approval, he must check it minutely to determine whether it conforms to the ASTE specifications for this material. If not, corrections must be made by the supplier.

Frequent inventories are taken of existing data sheets. When the stock of any given engineering sheet runs low, the contributor is invited to publish a reissue.

In all of these negotiations, the National and local Standards Committees, officers, and the Data Sheet Sub-Committee must be kept informed through copies of correspondence.

With painstaking accuracy, Stan also enters each Data Sheet in the numerical and alphabetical cross-reference file set up by the Data Sheet Sub-Committee for the indexing of this information.

New Standards Program

One of the newer Standards Committee projects, which will gather momentum as the Chapters get under way with their fall activities, is the formulation of standards for small tools, machines and accessories.

Five Chapters, selected according to geographical proximity, have been assigned to each standardization project, under the direction of a regional chairman appointed by the National Standards Committee.

Mr. Girard expects to inaugurate a complete new filing system to take care of the multitudinous details of this new enterprise.

A relative newcomer to the Society's staff, Stan became associated with ASTE last December. His business experience includes successive positions as Dispatcher in the War Department Motor Pool at Westover Field, Mass.; Secretary to the Supervisor of Training and Education for the Blind and Deaf of World War II, Veterans Administration, Washington, D. C.; Secretary to the Chief Engineer, Chevrolet Gear & Axle Div., General Motors Corp.; and Assistant Office Manager for Murchey Machine & Tool Co., Detroit.

He comes from Williamstown, Mass., in the Berkshires; attended Williams College where he played on the freshman baseball squad; and graduated from Bliss Business College in the neighboring city of North Adams.

Families, Picnic Guests

Muncie, Ind.—Approximately 50 members of Muncie Chapter and their families attended the first Chapter picnic recently held at Memorial Park, New Castle.

At noon the group enjoyed a basket dinner spread on outdoor tables. Prizes were awarded to winners of the day-long program of games and sports events.

Robert L. Weimer, Entertainment Chairman, and his committee were in charge of the pleasant outing.

Users' Requirements Basis of Handbook Index Philosophy

KEY TO THE wealth of data concerning methods, processes, techniques and materials and other engineering subjects to be presented in the first edition of the "Tool Engineers' Handbook" is the extensive index being compiled with careful consideration for the needs of its varied users.

Analysis of those expected to consult the Handbook reveals three classifications:

1. Expert tool engineers, who require a ready reference, technical terminology, detailed entry, specific page number, and liberal cross-indexing.

2. Executives or those in allied tool engineering professions, who look for analyzed subjects disclosing the information available in the text, under more general entries than required by Class 1.

3. Tyros, students or apprentices, who need non-specialized language and very general headings. Their purposes can best be met by an alphabetical table of contents apart from the index.

As the convenience of the tool engineer is paramount, there will be wide cross-indexing of subjects by likely catchwords. Unnecessary bulk will be avoided, however, by entering sub-topics, carried out to as many as four degrees, under one heading only. All other reference headings for the same subject will be cross-indexed to the detailed breakdown.

Most Indexes Inadequate

Major objection to some of the existing engineering handbooks is inadequacy of index. Of the estimated 1600 pages in the ASTE manual, 5% or 80 pages will be allotted to the index, as compared with 4.2% for the most completely indexed handbook now on the market.

More than 14,000 entries will be required to make the Society's Handbook completely useful under the indexing plan evolved for the publication.

Among the many authors whose works will be cross-referenced in the index are:

Dr. Samuel L. Hoyt, Technical Advisor, Battelle Memorial Institute, Columbus, Ohio, and author of technical papers and books on metallurgy, who has been active in the metals field for more than thirty years.

After graduating from the University of Minnesota with a mining engineering degree in 1909, he studied at Columbia University and at the Charlottenburg Technical School, Berlin, Germany, receiving a Ph.D. from Columbia.

Taught Metallography

For six years he served as Assistant and Associate Professor of Metallography at the University of Minnesota, going to General Electric Co. in 1919 to be Research Metallurgist. Twelve years later he became associated with the A. O. Smith Corp., subsequently becoming Director of Metallurgical Research. In 1939 he joined the staff at Battelle in his present capacity.

Dr. Hoyt is a member of ASM, AIMME, AWS, ASTM, Sigma Xi, the Army Ordnance Association and the Institute of Metals (England). Active in Schenectady and Milwaukee Chapters and the National Office of ASM, he has been a member of various AIME committees, including those of the Institute of Metals and the Iron and Steel Division.

He was the AIME Institute of Metals Lecturer in 1930, and the ASM Campbell Memorial Lecturer in 1940. Dr. Hoyt has served also on the ASTM Committee on High Temperature Alloys and is currently a member of the Welding Research Council of the Engineering Foundation.

Renowned for Work on Carbides

In the industrial world, he is particularly known for his leadership in the development of cemented carbides for cutting tools and for his work on temperature-resistant alloys. At the A. O. Smith Corp., an important phase of his duties was guiding the metallurgical development of high-strength oil-well casing, and vessels for the oil, chemical, and allied industries.

At Battelle, in addition to acting as advisor on varied metallurgical research problems, he directs the Institute's program of Welding Research.

In the spring of 1945, he was called upon by the War Department to serve as an expert consultant on a military mission, and spent three months in Germany investigating its wartime activities in metallurgical research.

A prolific writer on metallurgical subjects, Dr. Hoyt has made numerous contributions to the technical and trade journals, in addition to his published books and monographs. One of his most recent works is the "Metals and Alloys Data Book."

S. L. Hoyt

F. S. Badger, Jr.

Frank S. Badger, Jr., who has made metallurgical research his life work, now holds the office of Vice-President in Charge of Research and Development at Haynes Stellite Co., Kokomo, Ind.

An M.S. graduate of Massachusetts Institute of Technology, Mr. Badger entered industry in 1929 as a metallurgist for the Central Manufacturing Laboratory of the McCormick Works, International Harvester Co., Chicago, Ill.

After five years' experience on this assignment, he became Research Metallurgist for the Union Carbide & Carbon Research Laboratories, Niagara Falls, N. Y.

Joining Haynes Stellite in 1936 as Research Metallurgist, he was promoted to Technical Director before appointment to his present post.

Mr. Badger has addressed the Institute of Aeronautical Sciences and the American Society for Testing Metals, on metallurgical considerations in gas turbine designing. Several Chapters of ASM have heard his lectures on precision castings.

He is a member of ASM and AIMME.

* * *

Dwight A. Johnston, Sales Engineer for the Arms-Franklin Co. of Youngstown, Ohio, grew up in the communities of Warren and Alliance in that highly industrialized state.

After graduating from East Technical High School, Cleveland, he continued his engineering studies at Fenn College, John Huntington Polytechnic Institute and International Correspondence Schools.

Previous business connections include the positions of Assistant Chief Engineer with Yoder Co., Cleveland, Ohio; Roll Design Engineer for Kane and Roach, Inc., of Syracuse, N. Y.; Development Engineer at McKay Machine Co., Youngstown, and Chief Engineer, Standard Tube Co., Detroit.

D. A. Johnston

C. E. J. Brickner

During these associations, Mr. Johnston specialized in the design of improved types of roll forming equipment and electric resistance weld continuous tube mills, securing a number of patents covering features of these machines.

The author of a series of articles on "Cold Roll Forming Machines, Auxiliary and Related Equipment," that appeared in *Metal Stampings* and *Modern Industrial Press*, he is also an occasional contributor to *Steel*.

* * *

The importance of the tool engineer to industry is thoroughly recognized by **C. E. J. Brickner**, Manufacturing Engineer at Westinghouse Electric Corp., E. Pittsburgh, Pa., for he has been working with tools and equipment since graduating as a toolmaker from the Westinghouse trades training course in 1922.

Recommends Equipment

Tool design, time study, plant planning and layout engineering were included among his subsequent duties at Westinghouse until, in 1939, he was assigned to the Headquarters Equipment Department as an Equipment Engineer.

His present responsibilities include making recommendations and handling negotiations on manufacturing equipment for plants making everything from electric appliances to steam turbines and gears.

During the war, he helped procure tools to build machinery for atomic bomb plants, aided the appliance division in converting from refrigerators and ranges to airplane wing flaps, binocular bodies and insecticide dispensers. He also assisted in the tooling for electric torpedoes, ship propulsion equipment and Navy radar. Now he is engaged in procuring equipment to restore the converted plants to normal production.

Mr. Brickner is the immediate Past Chairman of Pittsburgh Chapter, ASTE, and Co-Chairman of the Host Chapter Committees making local arrangements for the Society's Semi-Annual Meeting in that city this month.

Detroit Member C. D. Lowell, Drafting Dept. Head at Wilbur Wright Vocational High School, and three of his students put their heads together on a designing problem. First-year pupils gain experience in shop practice.

Vocational School Serves Industry with Pre-Engineering Training

200 Firms Co-operate, Says Wilbur Wright's C. D. Lowell

"CO-OPERATING WITH INDUSTRY" is the successful slogan of Wilbur Wright Vocational High School and Technical Institute, Detroit, where ASTE'er Cornelius D. Lowell, Drafting Department Head of the municipal trade school facing the offices of *The Tool Engineer*, is helping to train tool engineers of tomorrow.

During the score of years that he has been associated with this project, Mr. Lowell has seen the number of companies offering cooperative work programs grow from a handful to 200.

In this period, the institution itself has developed from an outmoded building, mercifully razed by fire, to a modern two-story structure which has already required the addition of a third floor to accommodate the demand for its services.

Popularity of the cooperative method of training in metal working is evident in the enrollment figures which indicate that two-thirds of the school's 1200 students sign up for engineering subjects.

The entering class spends the first year in alternating two-week periods of class shop work and related theoretical studies. Subjects required for these two semesters include Shop (metal fitting and elementary machine operation), Related Drafting, Mathematics, English; American History, and Occupational Planning, a vocational guidance course.

Individual Teaching

Instruction at Wilbur Wright is on an individual basis, permitting each pupil to progress according to his own initiative and intelligence. Students may enroll at any time upon the satisfaction of entrance requirements, and graduate upon completion of the curriculum. Courses may be changed, too, as the youth determines his vocational aptitudes.

With a good attendance and scholarship record, a boy may begin his cooperative industrial work in his second year, alternating with another student in two-week job and classroom periods.

During this part of the course, Physics and Trade Drafting are added to the curriculum, replacing Shop Practice. In the Trade Drafting work, actual factory and engineering shop conditions are duplicated as closely as possible, each student having individual designing problems to solve.

In the final year, Chemistry, Civics, Economics and one elective subject are given, in addition to more advanced phases of Trade Drafting, Related Drafting, Mathematics and English.

One-Fourth Enter College

Upon satisfactory completion of his three-year course, the graduate may continue as an apprentice or with higher formal education, about 25% of Wilbur Wright alumni entering engineering colleges. This percentage corresponds favorably with the school's record of attaining the highest grades in senior intelligence tests of any Detroit high school.

In the Tool and Machine Division of the Manufacturing Curriculum, emphasis is placed on Machine and Tool Operation, Metal Bench Work, Heat Treating, Precision Tool Inspection, and Machine Repair and Construction.

Among other courses taught at the school are Automotive, Electrical, Power Plant, and Transportation Maintenance; Watch, Clock and Instrument Repair; and Office Occupations.

In addition to the regular day classes, a night school is conducted with Mr. Lowell as Principal. Radio, Electronics Body Drafting, Panel Tipping and Heating and Ventilating courses attract many to these part-time classes.

During the war years, Wilbur Wright evening students received instruction in tool engineering subjects from three other Detroit Chapter ASTE members—Floyd W. Eaton, Plant Manager, Crawford Door Co., and ASTE Finance Committee Chairman; George Demorest, Assistant Superintendent, Fisher Body Div., General Motors Corp.; and A. E. Rylander, Technical Editor of *The Tool Engineer*.

In its apprentice program, Wilbur Wright offers highly specialized courses to indentured apprentices, leading to certificates of accomplishment admitting graduates to the status of journeyman.

Aims of the school are to train workers for employment at one of three levels—technical, skilled trades, and the general industrial stratum—according to their ability.

"In starting boys as young as sixteen on a cooperative educational program," Mr. Lowell commented, "there are plenty of headaches—but the founders still believe it to be the most satisfactory type of education . . . for the boys who can take it.

Graduates Achieve Success

"Many of our graduates," he added, "have been granted engineering degrees with scholastic honors, attaining enviable positions and a diversity of achievements. There are numerous designers, process engineers, superintendents, works managers, owners and sales engineers.

"Those who do not have the extra spark," he pointed out, "become lead-off and layout men, and some who can't quite reach these heights may fall back on the fundamental trade skills for their living.

"In some instances," ASTE'er Lowell concluded, "a boy may turn from tools to chemistry or physics. After all, he won't get far away from processing or tooling—his development into a tool engineer is really more logical than haphazard."

Boring Machine Capable Of Precision Turning

Toronto, Ont. — Speaking before an audience of 90 members and guests, Carroll R. Alden, Research Engineer, Ex-Cell-O Corp., Detroit, Mich., discussed methods of precision boring and tools for precision boring operations, at the first fall dinner meeting of Toronto Chapter, held September 9 in Malloney's Art Gallery.

C. R. Alden

Mr. Alden emphasized that the boring machine base must be absolutely rigid as a first essential. Even when light cuts are taken, he explained, vibration would be apparent without a solid base. With slide illustrations, he detailed fundamental requirements for a rigid base.

A variety of machine operations—multiple boring, countersinking, spot facing and precision turning at high spindle speeds—were shown and described, along with useful data on spindle speeds, feeds and depth of cut. The machines illustrated were of the same basic design, but the variety of setups created many interesting tool engineering problems.

In the ensuing question period, boring operations and methods of grinding tool bits were further discussed and clarified.

Film Shows Gas Turbine

"Tornado in a Box," a sound film, presented in an attractive, readily understood form the development of the gas turbine. The production was shown through the courtesy of Canadian Allis-Chalmers, Ltd.

Previous to the showing, C. Southmayd of the Allis-Chalmers engineering staff, gave a brief talk on the development and possible applications of the gas turbine.

Chairman Walter Appleton, who opened the meeting, announced that L. M. Jardine, First Vice-Chairman, had requested a few months' leave of absence from the Chapter, while he is in the United States on business.

At a special meeting of the Executive Committee, it was decided that the function of First Vice-Chairman would be carried on through the co-operation of the remaining officers until Mr. Jardine can resume his duties.

The Chairman also stressed the need of promoting the Society through personal contacts with interested engineers who may be uncertain of the procedure for applying for ASTE membership.

Precision Tool Plant Seen in Sunnen Tour

St. Louis, Mo.—For their first meeting of the 1946-47 season, St. Louis Chapter members were guests of Sunnen Products Co., manufacturers of honing and grinding products.

Joseph Sunnen, President and founder of the company, was host to 335 members and guests for a delightful buffet dinner. After dinner, the regular meeting was called to order by Edward D. Ruder, First Vice-Chairman of the Chapter and Plant Engineer at Sunnen.

Following the business meeting, Mr. Ruder introduced Mr. Sunnen, a fellow Chapter member, as the technical speaker. His subject was "Industrial Honing and Development," describing various honing practices, including many applications developed during the war.

At the conclusion of Mr. Sunnen's lecture, the entire group was escorted on a tour of the plant. Approximately 30 supervisory employees conducted the party in small groups, explaining operations in minute detail. Sixty per cent of the Sunnen staff remained on duty during the evening, manning the various units, in order to demonstrate the many operations and manufacturing procedures.

The inspection tour, which encompassed practically all phases of manufacturing, emphasized the important role tool engineering plays from raw material to finished product.

Departments visited included modern die casting, heat treating, using Vapocarb and nitridizing units; production broaching; punch press, milling and drilling operations; lacquering and paint spraying, as well as a plating department in process of expansion.

The Tool and Die and Experimental Departments the members found equipped with the latest designs in machine tools and inspection equipment. In the Engineering Department, the tool engineers saw a unique production control unit, showing at a glance the overall production schedule and progress.

After the tour, the party gathered in the assembly hall for a few words from Vice-Chairman Ruder. Extending a standing invitation to all Chapter members who wished more detailed information on the plant's operations, Mr. Sunnen offered his assistance and that of his staff.

Area Industrial Exhibit To Show New Equipment

Williamsport, Pa. — Latest developments in manufacturing equipment and processes will be shown, October 21-24, to area manufacturers, educational personnel, technical students and the general public at the Williamsport 1946 Educational Industrial Exhibit in which Williamsport Chapter, ASTE, will cooperate. Location for the Exhibit will be the former R & G Knitting Mills building.

The four-day show, whose sponsors include Williamsport Technical Institute, the West Branch Manufacturers' Association, composed of representatives of all manufacturing concerns in the Susquehanna Valley; and E. Keeler Co., Williamsport, is under the active direction of the latter organization.

In addition to the booth exhibits, educational industrial films will be screened throughout the show.

The Exhibit will open Monday evening, October 21, continuing all day and evening, Tuesday and Wednesday, and closing at 6:00 P.M. Thursday. Members of the participating groups and invited vocational supervisors will attend the banquet to be held Thursday evening.

Below: In this partial view of the 335 tool engineers participating in St. Louis Chapter tour of Sunnen Products Co., the audience is listening to Mr. Sunnen's lecture, "Industrial Honing and Development." Top right: A Sunnen employee demonstrates broaching machine. Lower right: Members inspect finished products which they have seen in process of manufacture.

Members from 73 Chapters to Gather at Pittsburgh Convention

CHAPTER NO.	CITY	CHAPTER NO.	CITY	CHAPTER NO.	CITY	CHAPTER NO.	CITY	CHAPTER NO.	CITY
1	Detroit	15	Philadelphia	29	Houston	44	San Diego	59	(Port Arthur-Fort William, Ont.) Lakehead
2	Racine	16	Rochester	30	South Bend	45	Fond du Lac	60	New Orleans
3	Cleveland	17	St. Louis	31	Peoria	46	Portland (Me.)	61	Atlanta
4	Milwaukee	18	Dayton	32	Springfield (Mass.)	47	Akron	62	Erie
5	Chicago	19	Syracuse	33	Boston	48	(Washington, D. C.) Potomac	63	Portland (Ore.)
6	(Bridgeport) Fairfield Cty.	20	Schenectady	34	Greater New York	49	Williamsport	64	Springfield (Ill.)
7	Hartford	21	Cincinnati	35	Binghamton	50	Montreal	65	(St. Catharines, Ont.) Niagara District
8	Pittsburgh	22	(York) Central Pa.	36	Columbus	51	(Dallas) North Texas	66	Richmond
9	Toledo	23	(Moline, Rock Island, Ill., Davenport, Ia.) Tri Cities	37	Indianapolis	52	Wichita	67	Phoenix
10	Buffalo—Niagara Frontier			38	(Grand Rapids) Western Michigan	53	(Providence) Little Rhody	68	Flint
11	(Minneapolis-St. Paul) Twin City	24	Elmira	39	Seattle	54	Louisville	69	Pontiac
12	Rockford	25	Worcester	40	(Springfield, Vt.) Twin States	55	Windsor, Ont.	70	Muncie
13	Baltimore	26	Toronto	41	New Haven	56	Fort Wayne	71	Cedar Rapids
14	(Newark) Northern New Jersey	27	Los Angeles	42	Hamilton (Ont.)	57	Kansas City	72	(St. Charles, Ill.) Fox River Valley
		28	(San Francisco) Golden Gate	43	Nashville	58	Decatur	73	Evansville

Attendance at National meeting will represent record number of Chapters. Wherever heavy industry is concentrated on the North American continent, Tool Engineers may find a nearby Chapter of ASTE. Chartered groups of the Society's members extend from the rugged coast of Maine to the sunny shores of California and from the Northwest to the Gulf of Mexico. Beyond the borders of the United States are six Chapters located in the Provinces of Ontario and Quebec. Newest Chapter was recently chartered at Evansville, Ind. In addition to the 73 Chapters with which most of the 18,000 members are affiliated, a rapidly-growing At Large membership is drawn from foreign manufacturing cities around the world. Chapter cities, indicated numerically on map and identified in legend, indicate westward and southward movement of industrial manufacturing. During the war years, members and Chapters of the Society nearly doubled, reaching out into new manufacturing areas and aiding in their development.

Improvements Eliminate Leaks in Hydraulics

Grand Rapids, Mich.—Opening meeting of the new season for Western Michigan Chapter was held September 9 in the Rowe Hotel, with an attendance of approximately 50 members and guests.

In a short business session, James Brierley, Chairman, reviewed the organizational features of the Society, stressing the importance of properly functioning committees.

Speaker of the evening was Earl Cannon, Hydraulic Engineer for Elmes Engineering Works of Chicago, whose topic was "Hydraulic Presses in Deep Drawing."

Mr. Cannon compared advantages and disadvantages of hydraulic presses and mechanical presses, emphasizing that each type excelled in certain fields. New packings and welding, he pointed out, have practically overcome leaks in hydraulics.

The speaker also mentioned the uniform speeds and pressures inherent in hydraulic presses and the fact that smaller frames could be used for hydraulic units as compared to mechanical presses. Hydraulics, he concluded, are easy to set up and cannot be overloaded.

At the conclusion of his talk, Mr. Cannon answered a number of questions from the floor.

Coming MEETINGS

BUFFALO-NIAGARA FRONTIER — October 9, 8:00 P.M.—American Legion Post, Kenmore, N. Y. Speaker: J. R. Harbaugh, Metallurgical Service Engineer, Jessop Steel Co., Washington, Pa. Subject: "Tool Steels and Tool Steel Failures."

CEDAR RAPIDS—October 16, Montrose Hotel. Dinner, 6:30 P.M.; technical session, 8:00 P.M. Speaker from The DoAll Co. Subject: "Contour Sawing." November 6. Speaker: George H. Sanborn, Chief Field Engineer, Fellows Gear Shaper Co., Springfield, Vt. Subject: "The Art of Generating and Gear Manufacturing Equipment." December 18. Annual Christmas Party.

CINCINNATI—November 12, 6:30 P.M., Engineering Society Headquarters. Speaker: Dr. Harry B. Osborn, Jr., Director of Research, Ohio Crankshaft Co., Cleveland, Ohio. Subject: "Induction Heating." December 10, 6:30 P.M. Plant visitation. American Rolling Mill Co., Middletown, Ohio.

CLEVELAND—October 18, Allerton Hotel. Joint meeting with Society of Plastics Engineers. Speaker: Donald Gibb, Manager of Plastics Dept., The Dow Chemical Co., Midland, Mich. Sound film, "The Shape of Things to Come," by Boonton Moulding Co. October 25, 1:30 P.M. Tour of National Advisory Committee for Aeronautics Laboratory, Cleveland Airport. November 8, 6:30 P.M. Dinner and plant tour, Warner & Swasey Co. December 14. Christmas Party, Hotel Carter.

DAYTON—October 14, 6:30 P.M., Plant Visit and Dinner, Monarch Machine Tool Co., Sidney, Ohio. Subject: "Contour Cutting in a Lathe." Demonstration of standard equipment. November 11, 6:30 P.M., "Home Night." Film program. Election of First Vice-Chairman.

DECATUR—October 14, 6:30 P.M., The Decatur Club. Speaker: Harry Coopland, Special Representative, Jack & Heintz, Inc., Cleveland, Ohio. Subject: "Seeing Is Believing." November 11, 6:30 P.M. Speaker: Chester Mott, Metallurgist, Fansteel Co., Chicago, Ill. Subject: "Hard Facing of New Tools and Its Use in Tool Repair." December 6. Speaker: George Sanborn, Fellows Gear Shaper Co.

ELMIRA—October 7, 7:00 P.M., Mark Twain Hotel. Speaker (tentative): Dr. Lillian M. Gilbreth, Management Consultant. Subject: "Motion Study." Original films of Frank B. Gilbreth will be shown. November 4. Speaker: Harry Coopland, Jack & Heintz, Inc., Cleveland, Ohio.

FOX RIVER VALLEY—December 3, Ladies Night.

GOLDEN GATE—October 16. Speakers from Ryan Aeronautical Corp., San Diego; and General Electric Co., San Francisco, Calif. Subject: "Jet Propulsion." November 20. Speaker: Robert J. DeRoche, Carborundum Co., Los Angeles, Calif. Subject: "Crush Grinding."

HAMILTON — October 11, 7:00 P.M., Walper House, Kitchener, Ont. Speaker: L. M. Krull, Bay State Co., Ltd., Brantford, Ont. Subject: "Refinements in the Manufacture of Abrasives." November 8, 7:00 P.M., Fischer's Hotel, Hamilton. Speaker: Eric Palin, Chief Instructor of Electronics, Rehabilitation School, Toronto, Ont. Subject: "Electronics — 'Castles in the Air'." December 13, Royal Hotel, Hamilton. Speaker: Donald Thorburn, Manager, Brantford Engineering & Equipment Co., Brantford, Ont. Subject: "Fundamentals Governing Selection of Furnaces and Fuel."

HARTFORD—October 7. Dinner and coffee talk, City Club. Technical session, Hartford Gas Co. Auditorium. Speaker: A. W. Merrick. Subject: "Precision Castings." November, Tenth Anniversary Meeting.

LOUISVILLE—October 8. Speaker: Claude M. Sheridan, Allegheny Ludlum Steel Corp. Subject: "Stainless Steel." December 10. Speaker: Harry Coopland, Jack & Heintz, Inc., Cleveland, Ohio.

MILWAUKEE—October 10. Speaker: Dr. Hilton Ira Jones, Hizone Research Laboratories, Wilmette, Ill. Subject: "Peeps at Things to Come." November 14. Speaker: William K. Andrews, Engineering Sales Manager, Kearney & Trecker Corp., Milwaukee, Wis.

MUNCIE—October 9, 6:30 P.M., Y.M.C.A. Speaker: Dr. Harry B. Osborn, Jr., Director of Research, The Ohio Crankshaft Co., Cleveland, Ohio. Subject: "Induction Heating."

NORTHERN NEW JERSEY—October 8, 8:00 P.M., Hotel Robert Treat, Newark, N. J. Speaker: Roy Rabe, George Gorton Machine Co., Madison, Wis. Subject: "An Exact Duplicate."

PITTSBURGH—October 10-12, Semi-Annual Meeting, ASTE. October 10, Natl. Constitution and By-Laws, Education Committee Meetings. October 11, Natl. Editorial Committee Meeting. October 11-12, Semi-Annual Meeting, Board of Directors. October 12, Natl. Membership, Judicial Committee Meetings; Semi-Annual Dinner; Hotel William Penn.

TOLEDO—October 9, 7:00 P.M., Toledo Yacht Club. Speakers: Leonard C. Grimshaw, Chief Metallurgist, and Ray P. Kells, Chief Service Engineer, Latrobe Electric Steel Co., Latrobe, Pa. Subject: "Effects of Modern Developments in High Speed Steel." November 13. Speaker from Denison Engineering Co., Columbus, Ohio. Subject: "Hydraulic Presses in Industry."

TORONTO—Father and Son Night, October 21, Concert Hall, Royal York Hotel. Speaker: His Worship Robert H. Saunders, K. C., Mayor of Toronto.

WILLIAMSPORT—October 14, Bellefonte, Pa. Speaker: Adam Gabriel, Vice-President, Acme Industrial Co., Chicago, Ill. Subject: "Light Waves and Their Use in Precision Shop Measurement."

Entertainment Committee Puts on Field Day

Hamilton, Ont.—More than 250 members and friends of Hamilton Chapter enjoyed the highly successful Annual Field Day recently staged at Dundas Golf and Country Club, under the direction of the Entertainment Committee, chairmanned by Charles Kemp.

Numerous prizes were awarded for high score in golf, horseshoe pitching, nail driving and other contests.

Hamilton members enjoy Annual Field Day. Below, upper: V. Chmn. Gordon Hall (right) and his associates. Lower: Center of interest is the scoreboard. Upper right: Entertainment Chmn. Charles Kemp checks up with Standards Chmn. "Sid" Werthmiller (seated). Lower: Bob Smith and Dave Olsen get workout pitching horseshoes.

Situation Wanted

AS SUPERINTENDENT or executive assistant to plant manager. Desire position with progressive firm. Twenty years' experience from operator to superintendent. Know machine shop methods. Expert in grinding. No objection to management in allied work on foreign soil. Excellent references. American, 37. ASTE and ASM member. Write Box 101, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

"Hounds" to Bay Again At Pittsburgh Meeting

Pittsburgh, Pa.—Revival of the exclusive ASTE social club, known as the "Order of the Hounds," is being planned as an extracurricular feature of the Semi-Annual Meeting at Pittsburgh this month.

William Penn Hotel, birthplace of the "Hounds" during the 1938 convention in that city, will be the scene of the group's reunion.

Significance of the fraternity name springs from the mascot, "Snoopy," adopted by the convivial members of the extemporaneously-organized club. "Snoopy," a mechanical toy hound with sound effects, was one of the bewildering undruglike offerings, peculiar to drugstores, featured by the hotel apothecary.

Seizing upon this novelty as a symbol of the new "Order," its members initiated themselves by walking their barking canines through the William Penn lounge.

"Snoopy," mascot of the "Hounds," gets around in the best places. Here he accompanies his master, A. E. Rylander (right), and W. B. McClellan to the Engineering Society of Detroit.

Charter members included W. B. McClellan, Arnold Hague, Dick Thompson, Andy Rylander, W. A. Hart and J. W. Hansen of Detroit; Foster Dinger and Gardner Young of Pittsburgh.

Mr. Young, who is Reception Chairman for the Pittsburgh convention, requests members to bring their mascots and invites new members who can qualify. Entrance requirements, established at the second meeting of the "Hounds," held March 15, 1939, at the Harmonie Society, Detroit, compel applicants to "drag 'Snoopy' through the official convention hotel, contribute a token to the 'Hounds,' and throw one bone in the bone pit."

Functionaries "woofed" into office at this meeting were: W. B. McClellan, Leader of the Pack; Gardner Young, Ferocious Barker; and Dick Thompson, Guardian of the Bone Pit.

Impressive, numbered ,membership cards were issued, signed by the Ferocious Barker.

Carbide Tools Kept Sweden from Industrial Bog-Down

Sodertalje, Sweden — Carbide tools were a vital factor in maintaining industrial production during the war years when Sweden was practically cut off from the world, according to William E. Sjostedt, Chief Tool Designer, A/B Scania Vabis, Sodertalje, Sweden, and a recently-elected member of ASTE.

W. E. Sjostedt

"Before 1939," said Mr. Sjostedt, "the Tool Department of our company, automobile manufacturers since 1897, was concerned only with jigs, fixtures and common tool equipment."

But with World War II, came isolation from most of the world, ending imports of special machinery needed for expansion. All the special lathes, milling and grinding machines so urgently needed had to be designed and built within the country.

"We had to employ about four times the usual number of designers," added Mr. Sjostedt, "and order the machines from companies all over the country. Soon, the consequent shortage of designers, toolmakers, machine shops and materials slowed down delivery."

In August of 1940, the Industrial Commission issued bulletins restricting the use of high grade, high speed steels to the most important purposes.

"At that time," Mr. Sjostedt recalled, "we certainly were grateful that we had within our borders producers of cemented carbide-tipped tools. Without these cutting tools, our mechanical industry would have collapsed under the heavy demands made upon it during the war period."

Swedish plants, he observed, still booked with orders for several years ahead, are looking forward to securing new machinery and tools from America to help increase production.

In developing his engineering career, ASTE'er Sjostedt has alternated between the States and the Continent. In 1923 he began work with the Cleveland Tractor Co., subsequently being employed by the Perfection Stove Co. of Cleveland, Ohio.

Three years later he returned to Sweden for a year's service with Stal Finspong, manufacturers of steam turbines.

Then back to America where he was engaged by the Chicago Tuthill Pump Co. and Chicago Screw Co., respectively, in Chicago, Ill.

Going overseas once more in 1931, Mr. Sjostedt held engineering posts at Albin Motor Co., Kristinehamm, Stal Pressnings, A/B, Eskilstuna; and Volvo, Pentaverken, A/B Skovde, Sweden, before making his present connection in 1942.

He received his elementary education in his native Sweden, high schooling in Cleveland, Ohio, and his technical training at Bergsskolan, Filipstad, Sweden.

Whittle Reviews History Of British Jet Turbine

Portland, Ore.—Members of Portland Chapter, ASTE, were guests of the Oregon Section, SAE, August 16, when Air Commodore Frank Whittle, RAF, presented the "Early History of the Whittle Jet Propulsion Gas Turbine" at the Benson Polytechnic Auditorium.

Commodore Whittle, inventor of the British jet turbine, introduced his lecture with a Kodachrome sound film, "Britain's First Jet Planes." Slides illustrated his address spanning the evolution of the jet propelled gas turbine from its earliest inception to its present successful stage of development.

At the conclusion of the discussion period following Commodore Whittle's talk, a miniature "buzz bomb" was demonstrated.

Other guest groups attending the meeting included ASME, ASCE, SAME, GPMC, AIEE, AIME, PEO and ASM. Local chairmen of the various societies were introduced during the evening.

Record Attendance Enjoys Field Day

Toronto, Ont.—The sixth Annual Field Day brought out more than 200 members and guests of Toronto Chapter to participate in the golf and other activities scheduled for this event at the Elms Golf and Country Club, Weston.

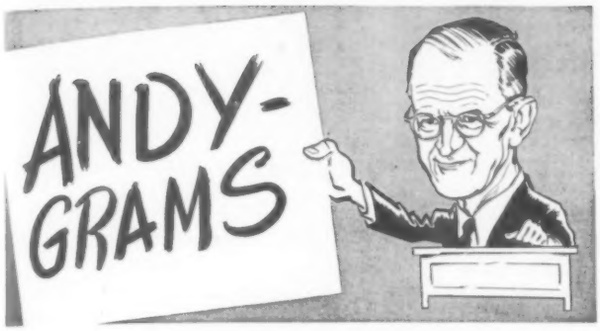
The engineers played ball, pitched horseshoes, drove nails crooked—a few straight—and acquired a good tan to tide them over the winter months.

As chicken dinners disappeared, the Chapter songsters came into their own, rendering many old numbers along with brand new melodies.

Walter Appleton, Chapter Chairman, awarded many useful prizes to winners of the various sporting events.

Attendance at the outing set a new record for the Annual Field Day which has become an institution with Toronto Chapter.

Chairman Walter Appleton's presentation speech, as he awards bottle of catchup to Past Chairman J. B. McRae, amuses this group during Toronto Chapter Field Day at Elms Golf and Country Club, Weston. Left to right: Registrar T. H. C. Alison, Chapter Membership Chairman; Joseph Row, Editorial and Public Relations Chairman; Mr. McRae, Harold B. Porter, Entertainment Chairman; Jack Turner, Assistant to Treasurer, and Mr. Appleton. The annual outing attracted over 200 members and guests.



WELL, HERE WE ARE AGAIN, all set for another convention—and, from what I gather from Prex Al Sargent, this is to be the biggest Semi-Annual in ASTE history. And it seems only yesterday that we convened, in Cleveland, at the biggest Annual so far held by any engineering society. Truly, time flies on golden wings! Anyway, you'd better come to Pittsburgh, the Host Chapter having promised us the keys to the city along with a regilded Golden Triangle.

Aside from the serious business of the convention—and there'll be plenty of that—Slim McClellan is calling the Hounds to heel. And this time we should be able to rally the pack, especially as Pittsburgh is the home kennel with Gardner Young guarding the bonepile. To start things rolling, Slim got me over to the Eng'g Soc'y of Detroit, where ASTE News Editor had us snapped along with Snoopy, now somewhat lop-eared after the wear and tear of war years and mauling by the Cyclone—i.e., my granddaughter.

So now, Hounds, come a baying!—which reminds me that, among my mementos, I have a bottle of Haig & Haig—empty, demmit!—autographed by all the Directors and officers who attended the Pittsburgh meeting in '38. The list includes Frank Shuler, past ASTE Prex and longtime master mechanic at Chrysler, honorably mentioned by Borth as a *Master of Mass Production*. Frank has recently been retired but, from what I gather, is rarin' to get back into harness. Well, better to wear out than rust.

Speaking for myself, I long since made plans for all of the things I want to do up to age 75, but the way they're coming of late I've had to extend my schedule of activities into the 90's—especially golf, which I've been saving for my old age. Had planned a trip to Li'l Rhody and points east, during September, a/c a tool engineering story suggested by Ed Berry, but had to defer it due to pressure of work. (I'll be seeing you soon, Ed.)

Had a pleasant luncheon with Roger Waindle, G.M. of Elgin Nat'l Watch Company's *Sapphire Products Div'n*, t'other day, during which I learned a lot of things about synthetic sapphires that aren't in the books. I imagine that Otto Winter will sleep easier for that get-together, our energetic past Prex having labored long and tirelessly to effect a meeting. Thanks, Ot! Roger's a swell guy and knows his stuff, and I'm a wiser and happier man for having met him.

Among letters, one from P. Grodzinski, technical consultant for *Industrial Diamond Review* (British) commenting on *Tool Engineer* reprints and suggesting ways to make them of greater permanent value. Well, we're trying. Speaking of letters, they come in faster'n I can answer 'em, especially when requests for "know-how" are beyond my immediate ken and the answers must be dug up.

Took us four months to trail one poser to its lair (it wasn't in any of the books) which goes to show that, like the postage stamp, we stick to a thing until we get there. In this connection, Arthur Cambria of U. S. Broach Company has volunteered to serve as oracle on matters relating to broaching, and maybe we can get a few more avocational *associates* to stand behind a "Questions and Answer" column. Thanks for the kind offer, Art—and may your tribe increase.

A considerable proportion of letters, coming in, commend us on the presentation of articles, and that doesn't hurt our feelings a/c we take particular pains with the makeup of the book. But, being human, we slip once in a while, especially when belated "musts" necessitate a last minute rearrangement. Because of a recent lapse, on my part, a contributor expressed disappointment over the layout of his story—the first complaint we've had on the score of presentation.

Our up 'n' coming Editorial Associate, Fred Steiner (he's an ex-Prof with a flair for statistics) reduced this as follows: 18,000 circulation $\times$ 2 readers per copy* $=$ 36,000 $\times$ 17 (the last 17 issues) equals 612,000 readings. Hence, 1/612,000 $\times$ 100% $=$ 1/6,120 of 1% $=$ amount of criticism on layout during the past 17 months. Maybe that ought to make me feel better, but the percentage is still too high. I'm satisfied with nothing short of perfection.

**Fred's too conservative. I'd say there's at least five readers for every copy of* The Tool Engineer.

From one thing to another, I had a call from Harry Heffner who, for a number of years, has been conducting classes in public speaking for the Detroit boys. One thing I've noticed is that his "graduates" haven't lost anything as a result of Harry's coaching, that old trouper having a genius for making even the most inarticulate tool engineer think as well on his feet as he does on his seat. Good luck with your '46 class, Harry!—and maybe I'll come around for a P.G. course myself.

As you probably know, my various duties include review of reams of publicity releases on new developments, a mixed pleasure a/c we can't begin to publish even a tithe of the matter. What I get a big kick out of, though, is releases coming in from California. Seems that everything produced on the Coast is "amazing . . . gigantic . . . sensational . . . stupendous" and so on through the gamut of superlatives. Well, that's all right! Industries have been started, out there, without benefit of precedent—and, it may be added, without handicap of inhibitions—as a result of which the boys out west dared to rush in where conservatives feared to tread. And that, my hearties, typifies the spirit of the tool engineers who, in a few brief years, have just about revolutionized the industrial world. Okay, then, Californians, may your enthusiasm soar to stupendous heights! And we're all with you; North, East, West, South, tool engineers are evolving a better design for living.

One thing I'm not supposed to do is to stick my nose into politics (I believe I'm allowed to vote) and I don't really know how to get around this. Helluva problem! But it seems that one of our most popular members—Ralph E. Flanders—has been nominated for Senator from Vermont, and I'd just like to congratulate the folks in the Green Mountain State on their political gumption. Personally, I've long contended that our country'd be the better for a generous leavening of engineers, industrialists and business men in our governing bodies—you know, men with "know-how"—and the *man from Vermont* is qualified in all brackets. Skoal, Ralph!

Yours ASTEely,

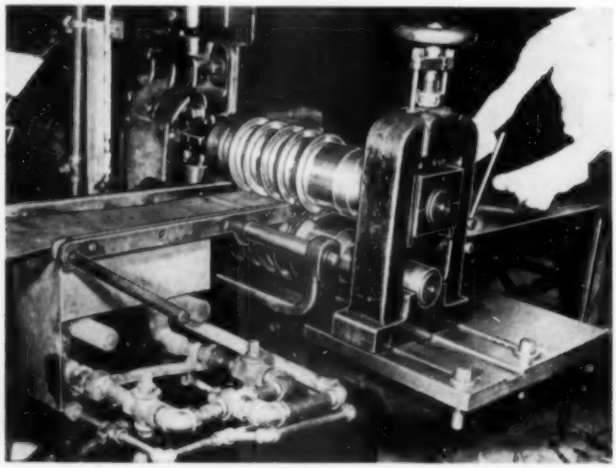
Andy

GADGETS

Annealer for Silicon Steel

WHILE SILICON STEEL has certain electrical characteristics that make it invaluable for use in electrical equipment, it is nevertheless extremely brittle and difficult to work. As a consequence, it is hard on tools used for its processing.

A gas burner installed on a slitting machine, as illustrated, has materially reduced losses of saws, due to breakage, when

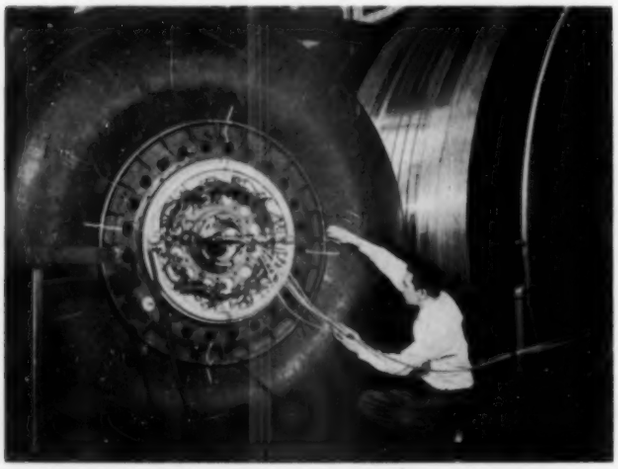


slitting this steel. The burner is attached to the front of the slitter and is connected to the shop gas and air lines. The burner is adjusted to heat the metal to the proper working temperature, and the steel is therefore adequately annealed before it reaches the slitting saws.

C. Choquette
Westinghouse Electric Corporation
East Springfield, Mass.

Giant Dynamometer

THE 110-inch tire is slammed against the spinning 158-ton steel inertia wheel to simulate the landing effect of America's giant future bombers. The dynamometer, used for test, was built by the Adamson Machine Co., in conjunction with AAF Air Technical Service Command. Controls and motors were built by Westinghouse.



Double-Sided Slide Rule

QUICK SLIDE for Thread Elements, a double-sided slide rule device available from Capell Designing Co., Box 993 Church St. Station, N. Y. 8, will prove valuable in quickly locating (for U. S. Standard threads) minimum and maximum measurement over wires for all classes, pitch diameter, major diameter, best wire size and constant, and other thread data including depth, flat and tap drill information. Price 95 cents.

Magnet Material Renamed

GENERAL ELECTRIC COMPANY'S permanent Magnet Material, formerly known to the trade as "modified Alnico 5" or "Alnico 5 plus Titanium," has been renamed Alnico 6. Composed of aluminum, nickel, cobalt, copper, titanium and iron, this material has a high resistance to demagnetization in addition to high external energy and residual induction values. A characteristic is that it has directional magnetic properties, hence, it must be magnetized in the direction in which the magnetic field was applied during heat treatment.

Statement of Ownership

STATEMENT of the Ownership, Management, Circulation, etc., required by the Acts of Congress of August 24, 1912, and March 3, 1933, of The Tool Engineer, published monthly at Detroit, Michigan, for October 1, 1946.

State of Michigan, County of Wayne—ss.

Before me, a notary in and for the State and County aforesaid, personally appeared Robert B. Powers, who, having been duly sworn according to law, deposes and says that he is the Executive Editor of The Tool Engineer and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, executive editor, technical editor, and business manager are: Publisher, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich. Executive Editor, Robert B. Powers, 1922 W. Canfield Ave., Detroit 8, Mich. Technical Editor, A. E. Rylander, 1922 W. Canfield Ave., Detroit 8, Mich. Business Manager, Jay L. Hammen, 1922 W. Canfield Ave., Detroit 8, Mich.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) American Society of Tool Engineers, Detroit, Mich.; A. M. Sargent, Detroit, Mich.; W. B. Peirce, Mt. Lebanon, Pittsburgh, Pa.; T. P. Orchard, New York, New York; I. F. Holland, West Hartford, Conn.; R. B. Douglas, Laval-sur-le-lac, Quebec; C. V. Briner, University Heights, Ohio; C. B. Cole, W. Chicago, Illinois; H. E. Collins, Houston, Texas; A. J. Denis, Hollywood, California; A. M. Schmit, Toledo, Ohio; G. S. Wilcox, Jr., Grosse Pointe Farms, Michigan.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state). None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is—(This information is required from daily publications only.)

Signature of editor, publisher, business manager, or owner. Robert B. Powers. Sworn to and subscribed before me this 1st day of October, 1946. Doris B. Pratt. My commission expires May 25, 1948.

Drilling and Boring Tools

Installment No. 3 of a Series

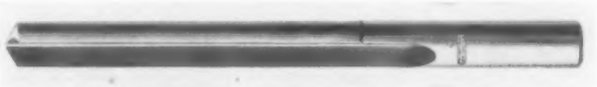
WHILE THIS Series will embrace what may be termed hole engineering in most of its phases, including jigs, fixtures and cutting tools, it may be well to first ground the student in the various types of drills used, and the purposes for which they are designed.

While the common twist drills are so universally used that they are taken for granted, all drills are not provided with helical flutes, as shown by the straight flute drill below, designed for drilling soft metals, and sheet metal. Because of the straight cutting lip—parallel with the axis—these do not bite or "grab" in such metals as brass and copper, or when breaking through sheet metal, with consequent stalling and possible damage to tools and injury to the operator. However, the "bite" can be taken from conventional twist drills by grinding the cutting lip straight for a short distance.

Among special purpose drills is the stove burner drill, especially designed for drilling multiple holes in gas plates. Because the castings are rough, tending to deflect the drills, these drills are made with comparatively short flutes and a tapering web section, for greater strength. The short flutes tend to reduce "springback," which commonly occurs with small drills.

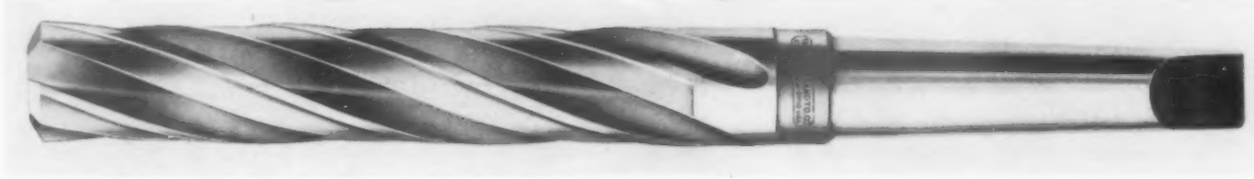
These drills may be had straight shank, or with threaded shanks as shown in the illustration. The latter design is especially advantageous when drills are held to close centers, as in multiple drilling. They can be threaded into the spindles instead of being gripped in chucks which, under the best of conditions, would be considerably larger than the spindle diameters. With crank driven spindles, in multiple drill heads, small drills may be held as close as $\frac{5}{16}$", center to center.

For larger holes, core drills may be used to size holes that have been cored in castings. To all practical purposes, these drills follow conventional twist drill design, except that, as no cutting is done by the point, the flutes are made somewhat shallower, with consequent thickening of the web. As



Above, straight flute drill; below, stove burner drill. Photos by courtesy of the Cleveland Twist Drill Company.

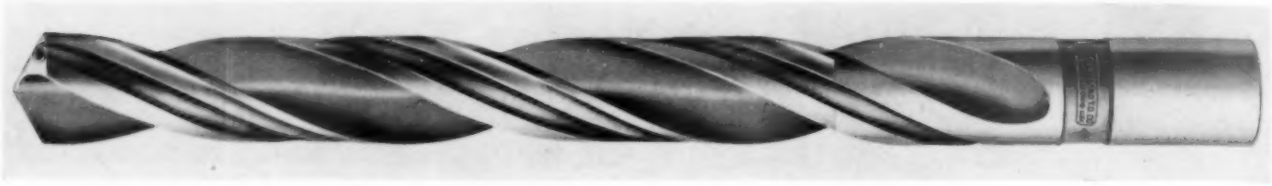
Inserted bit core drill, set into body of helical flute drill, which carries away chips. Illustration by courtesy of Mr. S. A. Oliver, Standard Mach. & Tool Company, Ltd., Windsor, Ont.



Above, 3- and 4-flute core drills. Photos by courtesy of the Cleveland Twist Drill Company.

Below, subland drill. Photo by courtesy of Detroit Reamer & Tool Co.

Above, oil hole drill with drilled holes. Below, oil hole drill with tubes. Photos by courtesy of the Cleveland Twist Drill Company.



a result, there is greater strength and a considerable reduction in springback. Core drills may be had 3-flute and 4-flute, to suit various conditions and metals.

Core drills may also be made with inserted tips, the latter made after the manner of a burr, to be replaced when worn. The body has conventional but shallow helical grooves, for easy chip removal; in all other respects, however, inserted tip drills function in the same manner as solid core drills.

Also, among special purpose drills, is the subland or stepped drill, of which the widely used and well known combination center drill and reamer is a good example. These drills are designed for drilling two diameters in one pass, the larger diameter acting more or less as a reamer, following the smaller or starting drill.

The subland drill is a comparatively recent development, and was inspired by the practice, in the past, of "converting" ordinary twist drills by grinding a smaller diameter at the end. One drawback, with that method, was that the step could not be reground without necking the small diameter; as a result, drills so converted had a comparatively short life. As now made, however, these drills have independent cutting lips and flutes for each step; consequently, either diameter may be ground without disturbing the other.

In the preceding installment, we touched briefly on deep hole drilling. For such work—and especially where high production is involved—oil hole drills are widely used. In this connection, it should be obvious that, in conventional twist drills, coolant cannot be directed to the cutting points. Chips, in the flutes, would effectively bar entry. But, by forcing the coolant through ducts and under pressure, it not only lubricates and cools the cutting edges, but aids in clearing the chips.

Below, oil hole drill with milled ducts enclosed by brazed-on strip. Detail of construction at right. Photo by courtesy of Detroit Reamer & Tool Co.

Oil hole drills are made in three styles. In the one, the oil holes are drilled through—a tedious process—after which the flutes are hot twisted and then milled. One trouble with this method is that the oil holes may run out, with possible break-through. As an improvement—and time saver in manufacture—auxiliary grooves are milled, following the path of the flutes, and tubes are inset into these grooves.

As a yet later development, grooves are milled and sealed with mild steel strips or shields, brazed in place. This method has the advantage that the ducts are considerably larger in area, permitting passage of a greater quantity of coolant. Subland drills may also be provided with coolant ducts by this method.

Additional comments on drills and their functions, together with a discussion on the grinding of drills, for various metals, will follow in the next installment, this Series.

At bottom, subland drill with milled and shielded oil holes. Detail of construction at left. Photos by courtesy of Detroit Reamer & Tool Co.

End of Part 3. Installment No. 4, this Series, will follow in the November issue, The Tool Engineer.

GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press

A THREAD WITHOUT END, by A. M. Sargent, in September *Modern Machine Shop,* is continuing evidence that many trade magazines are interested in what the modern Tool Engineer is thinking and doing. This guest editorial, which has created considerable interest in industry, originally appeared in July, '46, *The Tool Engineer.*

CANADA'S INDUSTRIAL RECONVERSION IS THREE-FOURTHS ACCOMPLISHED, in September 2, *Steel,* reveals that Canada expects to complete its reconversion program by next spring, and that modernization and expansion programs promise maintenance of a high level of employment and income, although some delays, in obtaining machinery and equipment, are at present retarding resumption of peacetime production.

From a survey of 643 plants, made by the Economic Research Branch of Canada's Dep't of Reconstruction & Supply, it is revealed that as a result of modernization and expansion, the firms covered expected not only to maintain their employment but to increase 3.4% over the figures for May 1, 1946, level.

Also, in *Steel,* September 16th issue, **TUMBLE IN STOCK MARKET STUDIED FOR HINT OF INDUSTRIAL TREND,** a staff-written article, reveals that machine tool builders are carefully watching developments in the security markets. The downtrend in securities has not, the article relates, been reflected in machine tool sales contraction, for interest in labor-saving equipment continues at high levels.

There has also been no appreciable increase in machine tool cancellations. Shortage of some materials continues, especially steel, with machine tool builders buying substitute material which ofttimes increases costs substantially. Hot rolled bar stock, for example, cannot be obtained in quantities to meet all requirements, thus necessitating the purchase of higher-priced cold finished material.

With release of the July, 1946, issue of the **METAL CUTTING DATA SHEETS,** *The American Society of Mechanical Engineers* makes available timely factual information about cutting tools and methods and particularly new information on the use of carbide-tipped tools, culled each month from research laboratory reports and industrial sources.

The new publication is an outgrowth of the metal-cutting Data Sheets published during the war by the Society for the Office of Production Research and Development of the War Production Board as an aid to the war effort. The former publication, 10,000 sets of which were distributed free throughout industry, was primarily devoted to milling data obtained as a result of government sponsored research at the California Institute of Technology, Pasadena, California, and the University of Michigan, Ann Arbor, Michigan.

As an A.S.M.E. publication, however, the Metal Cutting Data Sheets have a much broader scope and aim to completely cover the metal-cutting field.

Subscription fee for 12 issues of the Metal-Cutting Data Sheets is $15.00. Subscriptions should be addressed to The American Society of Mechanical Engineers, Publication Sales Department, 29 West 39th Street, New York 18, N. Y.

PROFIT-SHARING, by Burnham Finney in September 12th *American Machinist,* is another "Report to the Metal-Working Industries" which reveals that profit-sharing *has* its points, but only succeeds under the most favorable conditions. Its many failures far outnumber the successes. The writer outlines the pros and cons of profit-sharing with several examples of individual experiences.

The author traces the development of profit-sharing in America from the days of 1869 when it was first tried out by a carriage builder in New York. A chart shows that the main reason for discontinuances of profit-sharing plans by 96 American and 397 British companies has been diminished company profits and losses, and, secondly, the apathy of employees or dissatisfaction of employers.

ELECTRONICS DIGEST, No. 2, published by *Westinghouse Electric Corp'n,* Pittsburgh, Pa., is a most readable story of electronics at work in such fields as FM and television, grinding machines rejuvenated by electronic drive, fluorescent lighting to increase industrial output, better die casting through radiography, and electrostatic air cleaning in a textile mill. There is also an understandable explanation of the electron theory.

DUCTILITY AND ELASTICITY OF WHITE AND GRAY IRONS, by R. A. Flinn and H. J. Chapin is a reprint of a speech, from *American Foundrymen's Association,* 222 W. Adams St., Chicago 6. The article shows that although white, mottled and gray irons are popularly considered brittle materials, they can be manufactured with definite elasticity and ductility as well as reproducible tensile strength.

TREATISE ON MILLING AND MILLING MACHINES, by *The Cincinnati Milling Machine Co.,* Cincinnati 9, is a 182-page book on milling machines, accessories, milling cutters, cutting materials and cutter sharpening—a 3rd Edition, authoritatively compiled with unusually clear photographs, charts and diagrams.

This is Section I of a complete treatise, on milling and milling machines, the balance of which will be published as soon as the tremendous amount of effort needed for such a work has been completed. Rather than delay until the entire book has been completed and printed, Section I has now been made available by Cincinnati Milling at the nominal cost of $1 per copy.

YOU-TRIUMPHANT! is the title of a new book written by Eugene J. Benge, President, *Benge Associates,* 20 N. Wacker Dr., Chicago 6, which can serve as a guide for the cultivation and development of executive talent and key personnel. The manual is intended primarily for those in industry who are striving to improve their lot by doing superior work.

The titles of the chapters indicate the scope of the book. Among them are "Make Your Environment Efficient," "Understanding Human Behavior," "Strategy in Handling Others," and "Want to Succeed." Over $110,000 was expended in preparing the volume; for example, all the tests and scales have gone through many accurate human laboratory checks to determine their dependability.

BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

EATON MFG. CO., Foundry Div'n, 9771 French Rd., Detroit 13, has available a booklet—*Eaton Permanent Mold Process for Producing Gray Iron Castings*—describing procedures used in volume preparation of gray iron castings in mechanically operated metal molds without pressure application. This is accomplished by using an Eaton Permanent Mold Machine—an actuating mechanism to open and close the permanent molds as they rotate about a central hub.

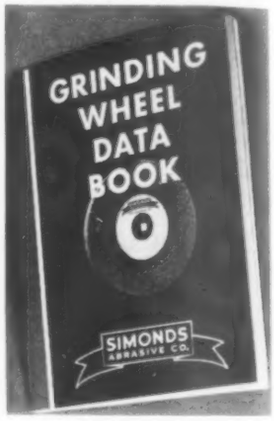
Streamlined Saw Gun, a folder by **MID STATES EQUIPMENT CORP'N**, 2533 E. 73rd St., Chicago 49, describes their Saw-Gun portable power-saw and file for attaching to electric or air drills, and flexible shafts, converting rotary action of the power unit to reciprocating motion. An ordinary hack-saw blade or file does the work with a rapid 7/8" stroke.

THE CARPENTER STEEL CO., Reading, Pa., offers a 91-page, *Notebook on Machining Stainless Steel*, which provides information on cutting costs in the machining of stainless, reducing rejects, overcoming troubles and the ironing out of kinks in machining practice. Priced at 50 cents.

Truarc Retaining Rings, a 48-page catalogue by **WALDES KOHINOOR, INC.**, 74-10 Austel Place, Long Island City 1, N. Y., contains applications of seven basic retaining ring types used to lock, secure and position moving parts.

SAFETY GRINDING WHEEL & MACHINE CO., Springfield, Ohio, has available an illustrated reference book, *Safety Grinding Wheel Facts and Figures*, presenting information on grinding wheels as to how to select the proper grades and types of wheels for hundreds of grinding jobs, how to correct faults, causes of unsatisfactory finishes and other valuable factual data. Also included are safety rules, complete ordering instructions, and several very convenient reference tables.

SIMONDS ABRASIVE CO., Tacony and Fraley Sts., Philadelphia, announces a revised edition of *Grinding Wheel Data Book* (Form ESA-52-6). Containing 127 pages of classified information on grinding wheels and practices, it also includes a Wheel Selection Table of recommended abrasives to satisfy many material problems, ranging from grinding of agate, alnico, forging dies and stainless steel, on down to the working of terra cotta, tile, valve seat inserts, and wrought iron.



KENNAMETAL, INC., Latrobe, Pa., has a new and attractive *Catalogue 46*, describing their standard line of cemented carbide products and such new additions as Grade K5H—an extremely hard Kennametal composition for precision boring of steel; pulley-grooving tools; saws for wood and plastics; and rolls for cold metal strip mills; as well as bearings, and screwed-on tip cutters for roller-turners.

THE OILGEAR CO., 1301-1417 W. Bruce St., Milwaukee 4, has released *Bulletin 25000* describing their new line of "XP" Vertical Pull-Down Broaching Equipment. Machines described range from five to 37½ tons pulling capacity, 24 to 66-inch stroke, all with automatic tool handling, push-button and selector-switch control.

Hufford Hydraulic Stretch-Forming Machine, a folder by **HUFFORD MACHINE WKS, INC.**, 207 N. Broadway, Redondo Beach, Calif., explains stretch-forming used for contouring extrusions, rolled stock and narrow ornamental and structural sheet uniformly and accurately.

Ammonia in Metal Treating, a 40-page booklet by **THE MATHIESON ALKALI WKS.**, 60 E. 42nd St., N. Y. 17, explains the use of ammonia, either as a furnace atmosphere or as a source of pure hydrogen, in nitriding, dry cyaniding, bright annealing, atomic hydrogen arc welding, copper brazing, powder metallurgy and oxy-hydrogen arc welding.

ROYAL OAK TOOL & MACHINE CO., 623 E. 4th St., Royal Oak, Mich., has released a new folder—*Form 7236*—describing the DS Tool Grinder, designed for angular back-off and a standard relief sharpening, as well as radial-helical grinding of taps, step drills, form milling cutters and form cutters. The machine has a 1⅛" maximum collet capacity, table travel 12⅞", with 3¾" maximum diameter between centers.

Leigh High Speed Grinder, a bulletin released by **SPRING SPECIALTY CO.**, 1219 W. Madison St., Maywood, Ill., describes Model VB-2 flexible shaft grinder which operates at free speed of 18,000 rpm.

Pratt Spiral Construction, a folder released by **PRATT INDUSTRIES, INC.**, Frankfort, N. Y., lists economies obtained by using their lightweight, inexpensive spiral construction tubing for smoke-stacks, forms for concrete construction, air conditioning ducts, and irrigation systems.

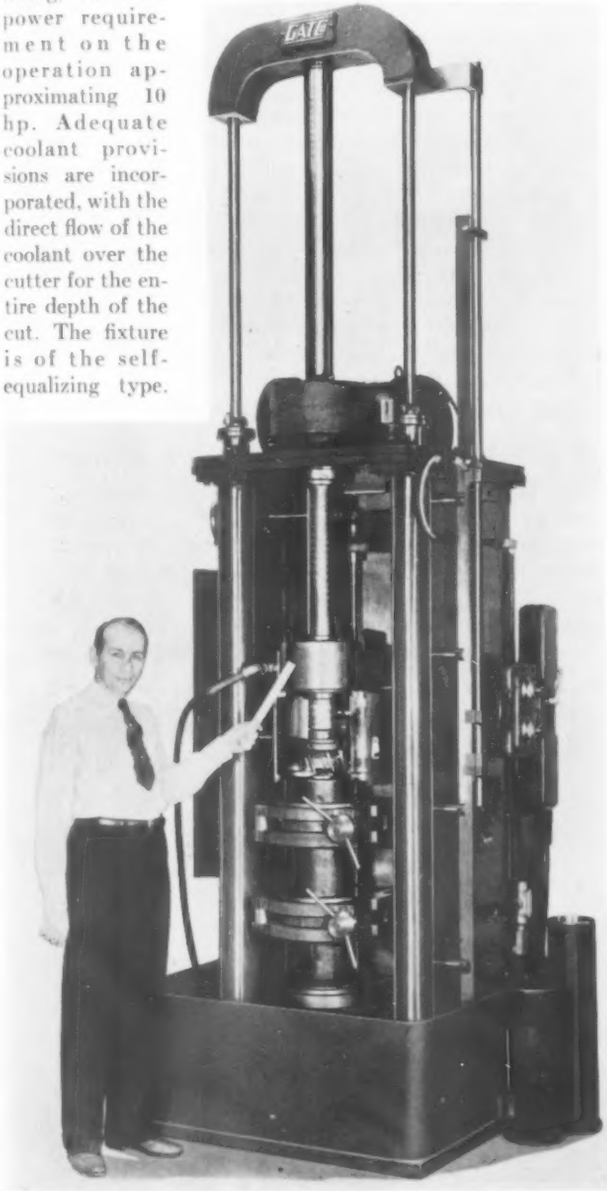
TOOLS OF TODAY

New Vertical Boring Machine

A NEW **VERTICAL BORING MACHINE**, for precision rough and finish boring of large cylinders up to 40″ in length and 6″ to 8″ in diameter, is announced by *Giern & Anholtt Tool Company*, 1302 Mt. Elliott Avenue, Detroit 7.

Identified as their TR Model, the machine offers extreme rigidity and accuracy with the spindle piloted directly above the work in a Gatco sealed rotary bushing. It is equipped to bore cast iron, steel or non-ferrous tubes using multiple blade boring cutter.

The machine is completely hydraulically operated and has a feed, on 8″ I.D. tubing, of 4″ per minute in roughing and 4½″ to 5″ in finishing, with the power requirement on the operation approximating 10 hp. Adequate coolant provisions are incorporated, with the direct flow of the coolant over the cutter for the entire depth of the cut. The fixture is of the self-equalizing type.



Hardinge Precision Machine

THE NEW MODEL DSM59 Hardinge High Speed **PRECISION SECOND OPERATION MACHINE**, by *Hardinge Bros., Inc.*, Elmira, N. Y., is designed for modern high speed production departments working to extremely close tolerances and finish specifications. The machine, which incorporates all the features of Hardinge second operation machine line, includes the following features:

Steel bed ways, of new improved dovetail design ground to master gages, after hardening, assure sustained accuracy and precision interchangeability of attachments. These form a solid steel bed top, while the dovetail construction protects the accurate angular way surfaces from falling chips and foreign matter. The bed has a three point mounting, on the welded steel pedestal base, insuring original bed accuracy even when the machine is placed on an uneven floor.

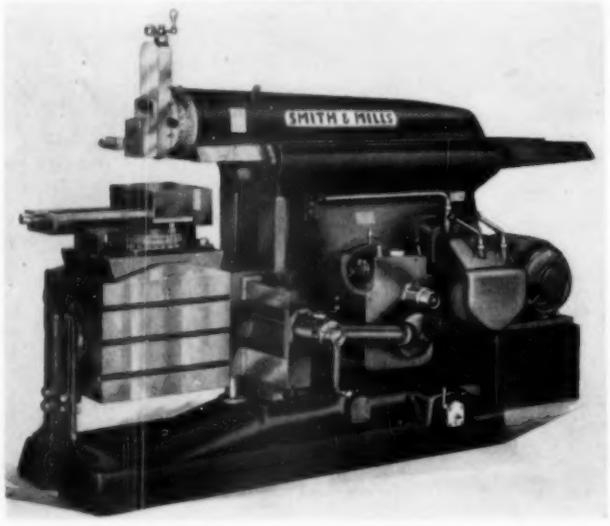
The headstock, fully enclosed, has a preloaded ball bearing spindle construction, with spindle ground to take standard 1″ capacity 5C Hardinge Collets and 6″ capacity step chucks. The spindle nose is supplied with either the Hardinge standard taper nose or Hardinge standard threaded nose for direct application of step chuck closers, jaw chucks and face plates. The headstock spindle is driven by a "center-drive" belt, easily replaceable without removing any part of the machine—a construction which places the belt between the spindle bearings for balanced bearing spread and equal distribution of belt pull.

For ease in operation, whether the spindle is at rest or at any operating speed up to 4000 rpm, the collet closer (for instantly closing and opening collets or step chucks) is ball bearing connected to the operating lever.

To insure rigidity and sustained accuracy, when taking heavy forming cuts, the rugged double tool cross slide has a constant full bearing on the base. The cross slide tool posts take standard ⅜″ square tool bits; when desired, however, the regular tool posts can be removed and number 00 circular form tools and holders applied to the cross slide. A straight or taper turning slide can be applied for turning or boring straight or angular surfaces.

Improved Ram for Crank Shaper

NEW TYPE **RAM,** completely eliminating the old style slot, has been added by *Smith & Mills Co.*, 2929 Spring Grove Ave., Cincinnati 25, to their line of 12″, 16″, 20″, 25″, 28″ and 32″ crank shapers. Self-locking ram position makes it unnecessary to lock the ram position manually, position being automatically maintained at point set by operator. Ram carrier is mounted to slide on bottom of ram, with thrust being taken on a large diameter ram adjusting screw mounted between ball thrust bearings. An automatic compensating double-nut, used to prevent backlash between screw and ram carriage, furnishes sufficient friction to prevent adjustment change under heaviest cuts.



Shearcutter Rotary Broaches

THE *Fearless Tool Company,* 1234 So. Gramercy Place, Los Angeles 6, which recently acquired the manufacturing rights of the **SHEARCUTTER ROTARY BROACH,** announce the production of a new type, of this tool, said to introduce an entirely new technique in producing holes. The technique is called "Rotary Broaching" because the tool is made with high spiral or helical cutting edges, and when end pressure is applied the broach rotates as it cuts and the helical cutting edges remove metal in a true shearing manner.

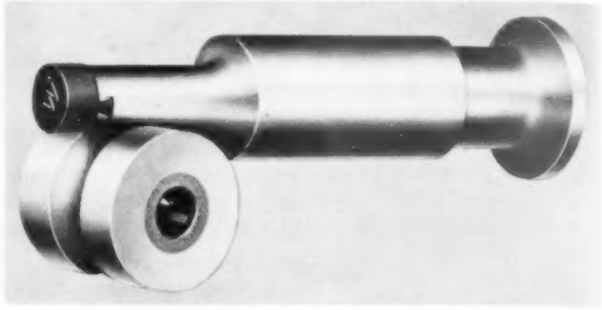
Rotary Broaches, which may replace reamers and conventional broaches, are said to produce absolutely accurate holes with a finish claimed to be incomparably superior to that produced by ordinary tools or other machining methods.

The cutting edge forms a true circle, consequently there is no tendency to produce elliptical, bell-mouthed or uneven holes. Remarkable savings in production costs are claimed of this revolutionary new tool and its unique principle of operation. They have a cutting edge life 5 to 10 times longer than ordinary tools before regrinding is necessary; in addition, they can be reground 10 to 30 times to produce a newly sharpened cutting edge before the diameter is reduced.

Further information about these tools may be had from the manufacturer.

Punch and Die Combination

THE *Penn Carbide and Alloy Casting Co.*, Canonsburg, Pa., now has available a new **PUNCH AND COMPACTING DIE COMBINATION** which has been designed to increase production and reduce die inventories in the pharmaceutical and powder metallurgical industries. Dies are of the conventional tungsten carbide type, utilizing a heat treated steel case, shrunk around an insert of Penn Carb



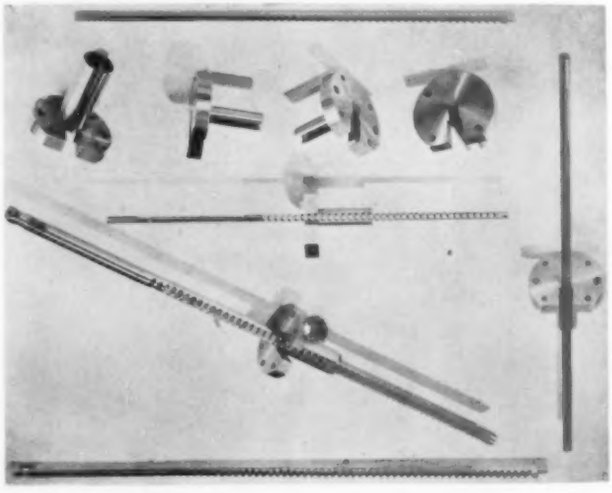
Punches, however, are produced with a dovetailed Penn Carb insert which is locked into the shank for added protection during operation. This improved punch design increases the bearing surface of the carbide and eliminates the possibility of misalignment caused by the braze taking a set when under pressure.

Another feature is the engraved carbide punch, made by the exclusive Penn Scribe process, which makes possible the engraving of complex and intricate designs on punches which are furnished with the proper draft for tablet compacting. The density and high polish of the carbide dies and punches are reflected in the sharp lines and smoother surface of compacted tablets.

In addition to the advantages of higher production runs and better surface obtained from carbide dies, users claim increased savings in lubrication costs due to the lower friction coefficient of tungsten carbide.

Standard Broaches by Zagar

STANDARD **KEYWAY BROACHES,** by *Zagar Tool Inc.*, 23880 Lakeland Blvd., Cleveland 17, are now made on a production basis and stocked as shelf items. Shown in the photograph are such standard keyway broaches in sizes ranging from 1/8″ to 1/2″. The adaptors, to fit them, are for broaching holes from 1/2″ diameter up to 1 1/4″. Both broaches and adaptors fit the 20″ Zagar Horizontal Broaching Machine.

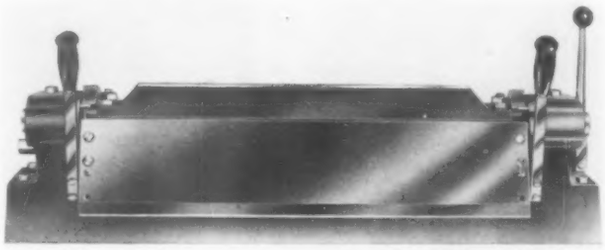


New Di-Acro Bender

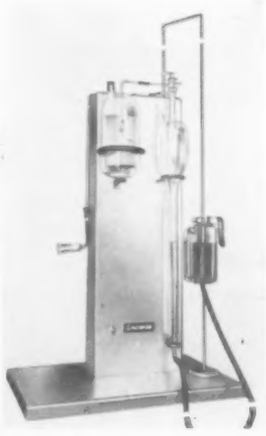
A NEW small brake bender, known as the **DI-ACRO BRAKE No. 4,** is the latest addition to the line of brakes manufactured by the *O'Neil-Irwin Mfg. Co.,* Minneapolis 15. Suited to bending sheet steel up to 16 gage, with a maximum forming width of 24", the new tool is ruggedly built and adaptable to a wide range of work in sheet metal shops and for forming and experimental work in die shops and general manufacturing plants.

Among major features are: A special material clamping action that assures extremely sharp bends; a double-edge vertical folding plate that allows forming of close reverse bends; Torrington roller bearings for ease of operation and increased speed; a quickly adjustable material gage, for precise duplication of formed parts, and precision angular degree stops.

An exclusive **DI-ACRO** feature is that the original contact surfaces can be quickly changed right on the job, thereby increasing the working range to cover forming of special and complicated shapes. A 4-page circular, describing this tool, as well as a 40-page catalog covering other **DI-ACRO** products, is available on request.



New Carbon Determinator



A NEW **VOLUMETRIC TYPE CARBON DETERMINATOR,** by *Lindberg Engineering Co.,* 2444 West Hubbard St., Chicago 12, introduces features dedicated to the idea that easier operation produces faster and more accurate carbon determination. A water jacketed, precisely graduated burette, mounted in front of a fluorescent light, provides easier reading and insures accuracy of one point of carbon—or better. The burette is graduated for 1-gram and ¼-gram samples, permitting full range use in analyzing the carbon of iron and other ferrous metals.

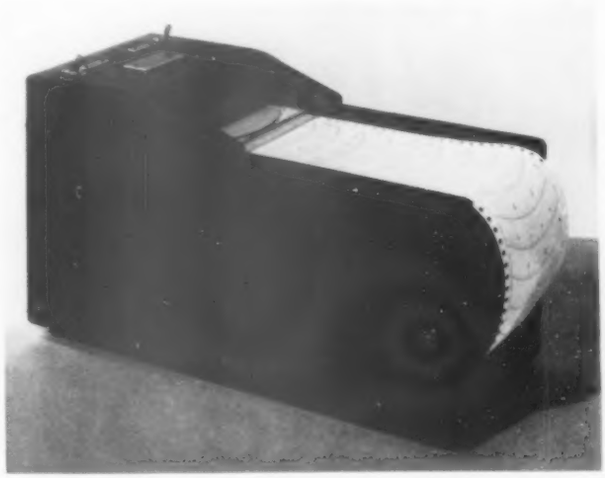
Although designed for use with Lindberg combustion tube furnaces, the new carbon determinator is easily adapted to any high temperature combustion tube furnace. The absorption chamber, which combines the use of glass tubing and glass heads, permits complete absorption in two passes although one pass will suffice for many alloys. A friction clamp holds the special levelling bulb at any desired point, with a micrometer screw providing quick and easy adjustment.

Profilometer Recorder

OPERATING AS AN attachment to the Profilometer manufactured by *Physicists Research Company,* Ann Arbor, Mich., a new Profilometer **READING RECORDER** has been especially designed, by P-R, for those who require a written record of the surface roughness measurement of a part. The Recorder provides a continuous chart record of average surface roughness.

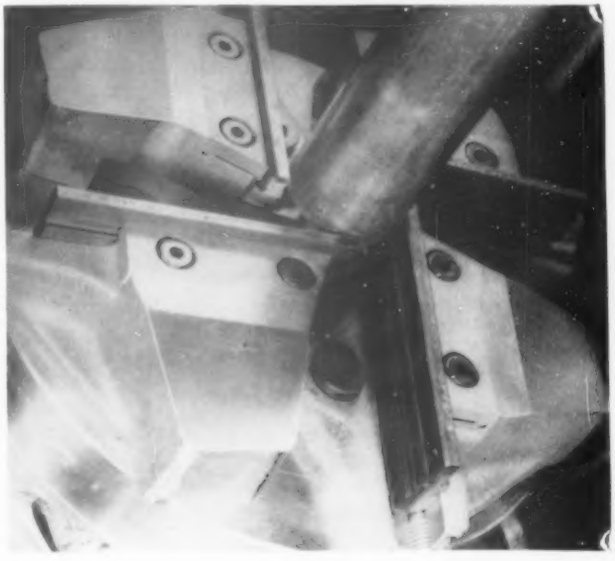
The charts, which are read in microinches like the Profilometer microinch meter, are useful in obtaining more detailed information on surface roughness, such as the location of rougher or smoother areas, and in supplying customers with records of the surface finish on parts delivered to them.

The Recorder attaches at the meter jack provided on all Profilometers, and no adaptations of existing Profilometer equipment are necessary. Complete information may be had from the maker.



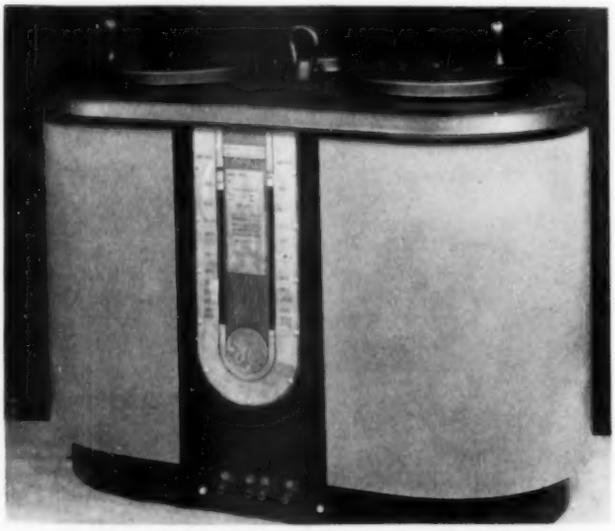
Centering Throat Chaser

FOR THREADING valve stems and other long length coarse pitch threads, a **CENTERING THROAT CHASER,** made by *Landis Machine Co.,* Waynesboro, Pa., has proved especially useful. However, since the chaser's throat section takes a bearing on the O.D., the chaser can be used only when the work O.D. is uniform. The chasers are flexible to the extent that differences on the O.D. can be corrected on the centering throat to maintain proper pitch diameter.



New A-C Arc Welder by G. E.

A NEW TWIN-UNIT, outdoor A-C **ARC WELDER**, contained in a single enclosure, is announced by the *Electric Welding Division* of the General Electric Company. Each of the two circuits in the welder can be used simultaneously and independently with electrodes up to 3/16 in. in diameter, or combined into one circuit for heavy welding with 3/8 in. electrodes. The units have a current range of from 90 to 270 amperes, when used singly and from 180 to 540 amperes when operated in parallel.



Both welders are equipped with control which reduces the open circuit voltage to approximately 30 volts when the machine is not welding, but which makes full power available the instant the arc is struck. Both halves are supplied through a single set of primary terminals, so that only one power-line circuit is required.

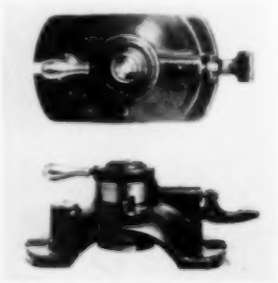
Protection against rain, snow, and sleet is provided by drip-proof construction of all openings in the top of the enclosure, and by a sealed window over the current indicators. Ventilating openings are proportioned to shed water and keep the ventilating air velocity low.

Collet Indexing Fixture

ORIGINALITY OF DESIGN is claimed as an outstanding characteristic of a new **COLLET INDEXING FIXTURE**, announced by the *G & H Mfg. Co.*, 327 Elm St., Fitchburg, Mass. Constructed to hold work for milling, grinding, drilling, shaper operations and bench work, the fixture can be positioned, either vertically or horizontally, on a machine table with equal facility.

As will be seen by the photograph, a chip clearance hole extends through the full depth of the fixture with ample space below for chip removal. Also, the smooth contour prevents accumulation of chips on the body of the fixture.

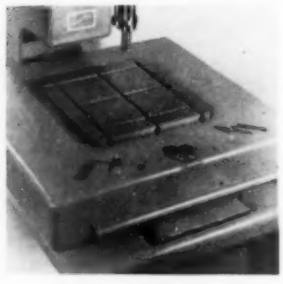
While collets commonly used in Brown & Sharpe automatics may be specified, any type of draw-in and push-out collets may be used provided the fixture is equipped with the proper closing piece. Removable screw insert stop buttons are used to block out unwanted indexing positions and the index plates are reversible and interchangeable.

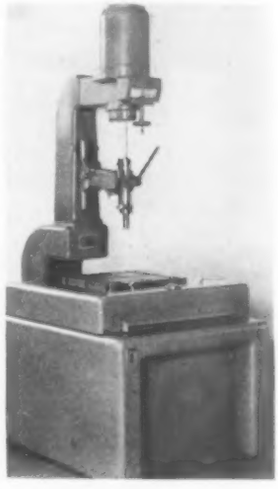


Speed-way Hole Spacer

A NEW MACHINE—The **SPEED-WAY**—by the *Speed Way Machine Company*, Worcester, Mass., is especially designed for accurate hole spacing, spotting, drilling and inspection. Accuracy is obtained by the use of projection magnifications, operating in somewhat the same manner as a motion picture projector. Thus, a light beam is projected through a translucent grid chart, where the original image is amplified to approximately sixteen diameters. The viewing screen occupies a central position on the work table directly in front of the operator and is therefore in an easy-to-see position at all times.

As shown, the machine is equipped with a standard Leland-Gifford No. 2-26 top column. The work positioning table is 20" x 20", with working range 12" x 12", vertical travel 9" and maximum distance from table to spindle head 18". Versatile in application, and designed for drilling and kindred operations where the use of jigs and fixtures is not ordinarily warranted, the machine is extremely accurate on tolerances within .002". It can be supplied, without the column, for mounting under a radial or standard drill press.





Drill Press Planer

EASILY AND QUICKLY fitted to any drill press, the new **SAFE-T-PLANE**, distributed by *A. D. McBurney*, 939 W. 6th St., Los Angeles, will plane, rout, panel, bead or rabbet to any depth in wood working materials. Positive cutting action, of the high speed steel shear-type blade, eliminates scraping or tearing in hard, medium or soft woods, including balsa, irrespective of grain. Special cutters are available for making square shoulder cuts and for non-ferrous metals and plastic products. Light in weight, with safety assured by a bell guard and retailing for only $5.95, the attachment should provide a valuable addition to the equipment of factories, pattern shops and home workshops.

New Power Wrench

A MOTOR-DRIVEN **POWER WRENCH**, by the *Fen Machine Co.*, 1323 Babbit Rd., Cleveland, is an interesting addition to the "Tools of Today." Designed to reduce chucking time and to eliminate worker fatigue from heavy "wrench wrestling," the attachment consists of an electric motor driving a wrench head adapted to the particular chuck being used. The wrench head is introduced into the socket and rotated and withdrawn by means of a simple hand control conveniently placed at the operator's left hand. This leaves the right hand free for handling of work.

The wrench does not need to be "set" for any specific operation, is not restricted in action but will move the chuck jaws to full extent of travel. Tension of the jaws is always at the control of the operator, a simple touch of the control lever regulating tension. Thus, one may have a light grip for thin walled parts or a heavy grip for heavier, solid work. Installed on a lathe or turret machine, the device should not only reduce loading and chucking time, but should increase the life of chucks. It may be used on any type of machine, or on bench stands, for any chucking, gripping or clamping operations.

Clamped-On-Tip Tools by K-M

TWO NEW TYPES of tools, for lighter machining jobs, are now being produced by *Kennametal, Inc.*, Latrobe, Pa. Provided with clamped-on, advanceable Kennametal tips, these tools are available in two styles: 1CL and 2CL, with offset shanks, and 11CL and 12CL, with straight shanks. Among advantages claimed by the maker are:

More consistent performance and greater durability from thermally strain-free assembly; smooth, unimpeded chip flow, assured by perfected and correctly positioned clamping; an exceptionally strong K-M tip, diamond ground on bottom face and firmly supported by the plane surface of heat treated steel shank. Drill tips may be advanced and repeatedly resharpened.

Reduced inventory, as tips of different grades may be interchanged; thus, since the shank serves as a permanent tip holder, the tool may be quickly adapted for the machining of different types of metal. Complete details may be had in K-M Catalog Supplement 2.

New Abrasive by Norton

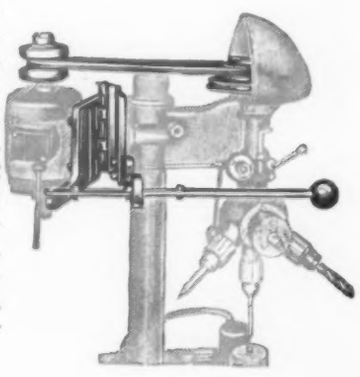
A NEW ALUMINUM OXIDE product, known as **32 ALUNDUM** abrasive, and announced by *Norton Company*, Worcester, Mass., is made by a unique electric furnace process which produces grains of an improved shape and structure. To fully appreciate the new product, consider that, in other types of aluminum oxide abrasives produced in the electric furnace, the crystals form in a solid mass with the size and shape of each crystal directly affected by adjacent crystals. Hence, they bear no relation to the size and shape of the final grains and must therefore be crushed to reduce the abrasive to commercial sizes.

On the contrary, the grains of the new 32 Alundum abrasive form as single, individual crystals which do not require crushing to size. Rather, they assume into chunky, nubbly shapes, the many plane surfaces of which form both exterior and reentrant dihedral angles, the latter making definite rake angles which increase the cutting efficiency of the grains.

The new abrasive is produced by a special furnace process invented at and patented by Norton Company, and consists essentially of fusing high purity aluminous ores in such a way that individual crystals, of commercial grain size, are formed in a fluid matrix. These are screened into standard grain sizes without crushing. Exhaustive tests, in user plants, have shown that grinding wheels made of the new Norton abrasive have longer life, require fewer dressings and a definitely faster and cooler cutting action.

Drill Press Speed Changer

THE **INSTANT SPEED CHANGER**, by *Chicago Drillet Corp'n*, 1729 N. Winchester Ave., Chicago 22, provides a quick and easy way to obtain, within the limits of step-cone pulleys, the approximately correct drilling and tapping speeds on all drill presses without having to manually change belts or to stop the motor. For example, a standard drill press, equipped with a Speed Changer and 4-step pulley, will have a speed range from 435 to 4550 rpm. The illustration shows the speed changer with Quadrill, the 4-position drilling and tapping turret head which provides 4 operations on one spindle. However, it can be installed on any drill press, without alterations or drilling of holes.



Sapphire Tools and Gages

A WIDE VARIETY OF **GAGES** and other **INDUSTRIAL TOOLS**, of sapphire, is now available from the *Sapphire Products Division* of the Elgin National Watch Company, 932 Benton St., Aurora, Ill. At upper right, in the group photo, are shown single and double style ring gages, mounted in gold plated brass. The center ring gage is mounted in plastic, and the smaller one, below, in gold plated brass.

At bottom left is a burnish-polishing tool, used mainly in the watch repair business as a pivot polishing tool. Immediately above, in the group of four, are sapphire tipped dial indicator contact points. The one at the lower tip of the "arc" is a standard contact point, the others are made to customers' specifications.

Running diagonally from upper left to lower right, in descending order, are: hand burnishing tool; sapphire tipped-type cylindrical plug gage; cylindrical plug gage with solid sapphire members; cylindrical plug gage with sapphire inserts; cylindrical plug gage with solid sapphire members; flat plug gage; needle valve gage; cylindrical plug gage with solid sapphire members and, last and least (in size) same as immediately preceding but of very tiny size.

Drill Press Converter

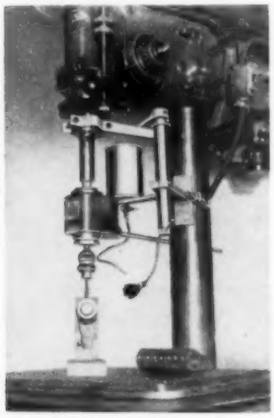
A NEW **DRILL PRESS CONVERTER**, by the *Leo G. Brown Eng'g Co.*, 1157 Riverside Drive, Los Angeles, quickly converts a standard drill press to perform filing, cutting, sawing or slotting operations. A solid steel cam, mounted between two pre-loaded ball bearings, converts the spindle rotation to a vertically reciprocating motion and, simultaneously, increases machine power output severalfold. The main housing is a high grade Durometal casting, with bronze sleeve inserts, and the cam roller is of hardened tool steel.

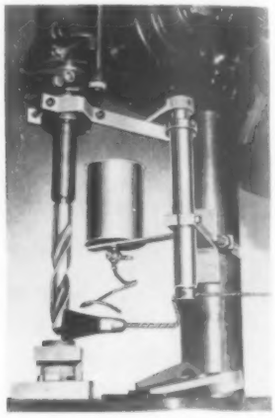
The attachment is available in 1" and 1¾" stroke models, and is priced, respectively, at $15.00 and $24.00 prepaid.

Jarvis Lubro Brush

A SIMPLE DEVICE, fully automatic and designed to automatically cool or lubricate drills, reamers, taps or other tools used in drill presses, is now available from the *Chas. L. Jarvis Company*, Middletown, Conn.

Action of the device—called the Jarvis **LUBRO-BRUSH**—is so obvious from the illustrations that description seems almost superfluous. In operation, however, a simple cam action transmits a short lift stroke into a sweeping action of the brush, when chips are removed and the tool lubricated for the next pass. Low in cost and easily installed, the device can be readily adapted to punch presses, hand millers and other machines where automatic cleaning and lubricating would effect savings in time and reduction in tool costs. Literature available.

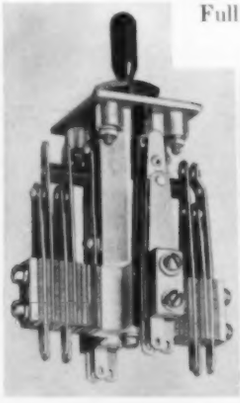


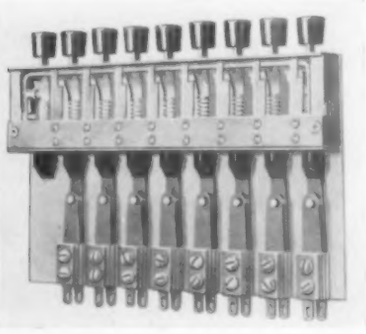


New Switches by G-C

General Control Co., 1200 Soldiers Field Road, Boston 34, announces two new switches—the Model MCF, a 5-position cam-lever switch (left) and the "Master" Model MPB, a 9-position push button switch in both locking and non-locking types. The model MCF is especially designed for ease in assembling and wiring, facilitated by a single hole mounting and a single bolt assembly of the contact block to the switch frame. The latter—a patented G-C feature—permits soldering the wiring to the contacts remote from the installation.

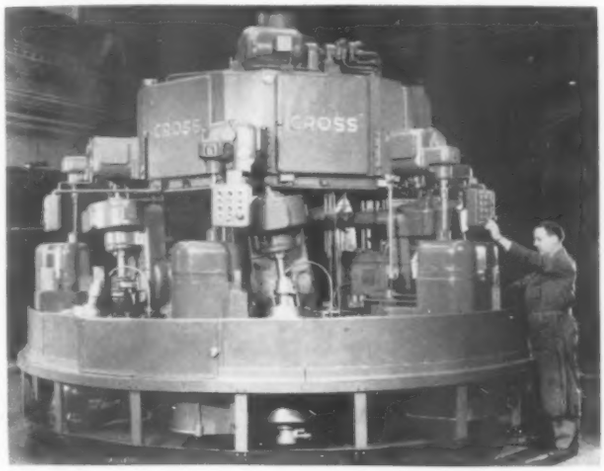
The switch is locking or non-locking in all positions except at center, which is always locking. Motion, from center to all switching positions is straight line; this, together with a positive roller action, results in maximum ease of operation. The model MPB is especially designed for use on electronic and communications equipment. The locking frame type has eight positions and one reset position—i.e., any switching combination, which has been set, can be released by one operation of the reset button. Full particulars in illustrated catalog.





Rotary Thread Miller

THIS SPECIALLY-DESIGNED **ROTARY THREAD MILLING MACHINE,** by the *Cross Company*, Detroit 7, mills the taper threads on 19 different models of oil drill cutters. Six self-contained, independent work stations are mounted on a circular bed with variable rotary feed. The feed is timed so that each station automatically completes the milling on one piece of work during one revolution of the bed past the operator's station. All the operator has to do is unload and reload the pieces, as the stations pass him, and to push a button to repeat the automatic cycle.

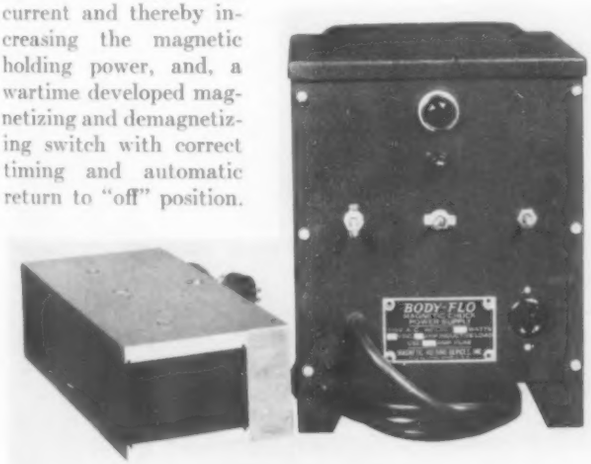


In this cycle, the motor-driven milling head quick-approaches to cutting position. With the cutter turning, the work head spindle spiral-feeds the piece upward into the cutter. Upon completion of the cut, the milling head moves back to idle position, and the work-head lowers while the spindle reverses. Production is from 20 to 40 oil drill cutters an hour, depending on the thread length of the various models.

Heavy Duty Magnetic Chuck

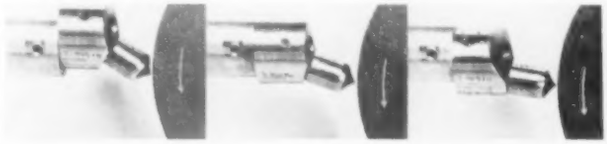
SUPPLIED WITH a power supply unit, a Heavy Duty 12" x 4" x 3½" **BODY FLO** Magnetic Chuck and parallel, by *Magnetic Holding Devices, Inc.*, 2034 East 22nd St., Cleveland 15, is especially adaptable to milling operations where difficulty is experienced in clamping the work. In this connection, magnetism holds work effectively when down or climb milling with non-magnetic carbide tipped cutters.

The power unit incorporates, as special features, power selector for stepping up current and thereby increasing the magnetic holding power, and, a wartime developed magnetizing and demagnetizing switch with correct timing and automatic return to "off" position.



Automatic Diamond Holder

THE BOOTH **AUTOMATIC SELF-CENTERING TURRET DIAMOND HOLDER,** by the *Diamond Tool Co.*, 938 E. 41st St., Chicago 15, can be used either in the adapter of a center grinder, or with a magnetic block, made by the same concern, for surface grinding. Increased diamond use is gained by employing a range of three different angles —30°, 20°, and 10°—each to its complete extent by rotation of the turret holder.



Mechanical action of the holder automatically centers the diamond point in each of the three angles directly at the point of grind on the grinding wheel, as shown left to right, for a cylindrical grinder, in the upper illustration. The lower photo shows location on a surface grinder, with the "gage" mark centered under the wheel spindle.

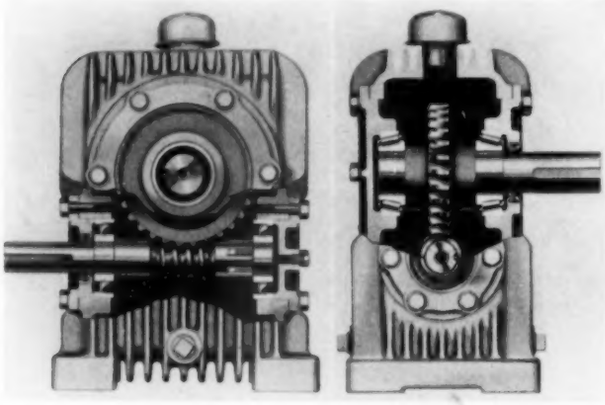
Peening and Scaling Hammer

A NEW AIR-POWERED **PEENING AND SCALING HAMMER** (Model 7002), added to the widely diversified line of industrial pneumatic tools by *The Aro Equipment Co.*, Bryan, Ohio, should find wide use in the industrial field for removing scale and rust on welded parts. It can also be used for removing sand on small castings, and for peening tubular rivets and other small parts.

The new tool delivers 5000 blows per minute, yet will not distort light sheet metal when removing scale. The body is of cast aluminum, with automatic throttle valve, and piston and cylinder are of alloy steel, precision ground. Overall length, of the hammer head, is 2½", and of the body, 7"—the whole small enough to get into tight places. The connection (stem) between body and the hammer head can be any reasonable desired length, thereby broadening application.

Cone-Drive Speed Reducers

A COMPLETE STANDARDIZED line of compact **SPEED REDUCERS,** built around double enveloping Cone-Drive gearing, is announced by *Michigan Tool Company,* 7171 E. McNichols Road, Detroit 12. These units, in various models to suit practically every requirement, are claimed to be quite startling considering the horsepower and torque they will transmit for a given size.

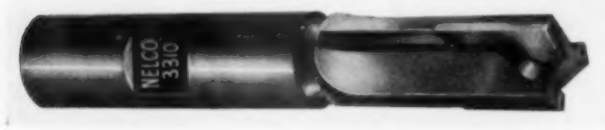


Prime reason for this, it is said, is the vastly greater load carrying capacity of Cone-Drive gearing, which has more teeth in contact and more contact per tooth than any other type of right angle reduction gearing. As a result, smaller gears can be used to transmit a given load, resulting in more compact housings. This compactness, incidentally, also adds to the sturdiness of the units, all of which are designed in anticipation of heavy duty service.

The new standardized line includes models with pinion under, pinion over, and with gear shaft vertical. The center distances of from 2 to 18 inches cover a power-transmission range equivalent to 3 to 24" center distance in worm gearing. This is indicated by the fact that horsepower ratings range up to 800 horsepower input to the pinion. In the smaller sizes, models light enough to be carried in one hand are designed for fractional horsepower work.

Carboloy-Tipped End Mill

DEVELOPMENT OF what is said to be an unusually efficient Carboloy-tipped **3-FLUTE END MILL** is announced by *The Nelco Tool Co., Inc.,* 370 Hamilton Ave., Brooklyn 31, N. Y., manufacturers of Carboloy-tipped cutting tools. The new tool is believed to be the first really successful Carboloy-tipped end mill capable of plunging into solid metal. It has also been proven extremely effective in the milling of plastics.

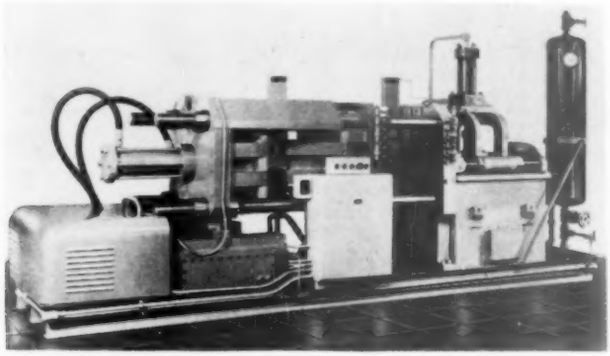


Providing more chip-room, and thus obtaining cooler and freer milling, this feature decreases the chance of work overheating and twisting and, as a consequence, considerably steps up production. In the milling of a keyway for example, the 3-flute end mill finished the job much smoother and in less time consumed in milling the same piece with a high-speed steel end mill.

The new end mill is manufactured for use on all types of alloy steel, cast iron, brass, bronze, and plastic material. Sizes range from $\frac{3}{8}$" to 2" diameter.

New Die Casting Machine

A FULLY AUTOMATIC, self contained Pressure **DIE CASTING MACHINE,** for zinc, aluminum and brass, is announced by the Die Casting Div'n of *Hydraulic Machinery, Inc.,* 12825 Ford Road, Dearborn, Mich. Termed "Hy-Mac" and identified as Model M-114, the machine is complete in all respects and is ready for installation and production. Equipment furnished includes a heating unit for metal, electric motor, oil pump unit, valves for water lines, filters or strainers on lines where necessary and shutoff valves at important places in oil and water lines.

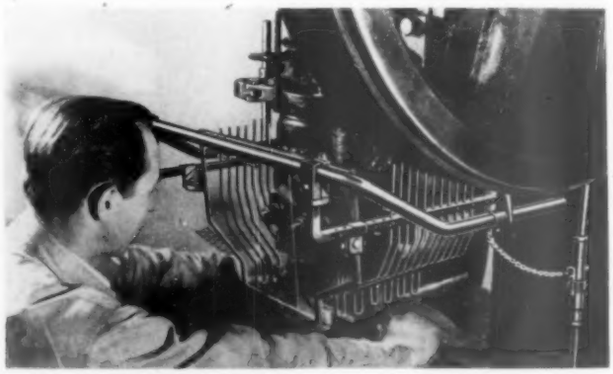


The base, of welded "automobile frame" construction, provides complete rigidity of machine and perfect alignment of dies. As for general design, the machine has been engineered for convenience and accessibility, thereby facilitating die changes and also changes from one metal to another.

Capacities of melting pot, for zinc and brass, is 500 lbs., and for aluminum 200 lbs. Size of die plates center to center of bars, is 24" x 24", or 20" x 20" between bars. Pressure per sq. inch on metal is 6,000 lbs. for zinc and 16,000 lbs. for aluminum and brass. Locking pressure is 400 tons. The machine weighs 16,000 lbs. and requires a floor space 54" x 180".

Power Press Guard

A NEW SWINGING **DIE ENCLOSED GUARD** by the *Junkin Safety Appliance Co.,* Tenth & Hill St., Louisville, Ky., has been especially designed for both side and front fed blanking operations and is fully adaptable to a wide variety of operations of this type.



The guard is easily adapted to afford full operator safety, while at the same time permitting easy and safe accessibility to the dies. It is completely adjustable, both vertically and horizontally, to all dies that the press may accommodate. And, once the gate is out of position the press cannot be tripped until the guard is swung back into "safe" position. As will be seen, the construction permits full visibility with practically no impediment to part production.

North East West South in Industry

LESTER B. BELLAMY has been named Manager, Detroit office, **Sterling Grinding Wheel Div'n,** Cleveland Quarries Company. Previously, Mr. Bellamy was Specification Sup't, Packard Motor Car Company. He is an enthusiastic A.S.T.E.'er, active in the Detroit Chapter, and member Nat'l Students Com., and Co-Chairman, Data Sheet Sub-Committee.

THE MONARCH MACHINE TOOL CO., Sidney, Ohio, has been granted an exclusive license, by the **Bailey Meter Co.,** to build and market to the machine tool field, a contour turning mechanism first introduced by the latter concern two years ago. The transaction, which involves a score or more basic American and foreign patents, is announced by **Wendell E. Whipp,** Monarch's President.

The unit, of which an improved version was shown in the Tools of Today Department, August, '46, *The Tool Engineer*, combines one or more air tracers with a hydraulically operated power circuit to produce workpieces with contours which match, with extreme accuracy, those of a master templet.

The new office building of **EGYPTIAN LACQUER MFG. CO.,** South Kearney, N. J., houses the sales, accounting and advertising departments, in close proximity to their laboratories and manufacturing facilities. However, according to announcement by O. J. S. deBrun, President, the company's executive headquarters will remain in Rockefeller Center, New York City.

GEORGE R. STANLEY, who has been appointed to the sales staff, **Chandler-Evans Corp'n,** Div'n Niles-Bement-Pond Co., West Hartford, Conn., was recently released from the Army with the rank of colonel. Among his awards are the Distinguished Flying Cross and Air Medal with Oak Leaf Cluster, received during his tour of duty with the Army Air Corps.

SPANG-CHALFONT DIV'N, The Nat'l Supply Co., Pittsburgh, announces promotion of **Charles J. Ramsburg, Jr.,** and **Eugene F. Conroy** as Ass't District Managers, New York Office; **Edwin A. Booth** as Pittsburgh District Manager and **Frank W. Morris** as Manager of the Tulsa District.

QUAKER CHEMICAL PRODUCTS CORP'N, Conshohocken, Pa., has announced the return of **Dorian C. Wilkinson,** recently released by the Navy, to his former position as Process Engineer. **John W. Burley, Jr.,** Army veteran, has joined the company's technical sales force; and **Wilbur R. Varney,** formerly metallurgical and manufacturing officer, Navy Ordnance, has been named liaison Engineer.

CHARLES E. WILLET has been named Sales Mg'r of **Burton-Rodgers, Inc.,** Cincinnati, according to announcement by Paul C. Rodgers, President. Mr. Willet will direct sales of educational devices, including scale models, and related equipment which the concern produces for the tool industry.

DAN W. HOLMES has joined **Parker Appliance Co.,** Cleveland, as Gen'l Sales Mg'r, succeeding **FRED E. AMON,** recently assigned as full time Mg'r of Aircraft Sales. **D. A. CAMERON** is the new Ass't Gen'l Sales Mg'r; and **HARVEY E. SCHROEDER** has been named to the Managership of the Pacific Div'n. Other appointments of recent months include **ROBERT H. DAVIES** as head of the Eng'g Div'n, with **LELAND H. SCHMOHL** as Chief Design Eng'r; **EMMET C. HARTLEY** as Mg'r of the Special Products Div'n; **HENRY M. REESE** as a special field sales application engineer, and **J. E. MURPHY** appointed Mg'r of Distributor Sales for Parker.

HARRY W. BARKLEY has been elected President, **Nat'l Tool Co.,** Cleveland, according to Samuel J. Kornhauser, Ch'man of the Board. Mr. Barkley was previously associated with The Ford Motor Company for 27 years, and succeeds Lewis F. Jubenville, who has been appointed Director and member, Exec. Comm.

ENGINEERING SERVICE, INC., Detroit, now has a west coast office at 406 E. Colorado Ave., Glendale, Calif., offering engineering service for the western industrial area.

HENRY & HUTCHINSON, INC., Decatur (Atlanta), Georgia, has been organized to engineer, design and build complete tooling programs, and all types of special machinery. Including experienced engineers and practical production men, in its organization, the concern aims to serve all fields of industry.

George D. Miller Co., Rockefeller Bldg., Cleveland, sales representative in the Cleveland area for **SIMPLEX MACHINE TOOL DIV'N** of *Stokerunit Corp'n*, Milwaukee, Wis., has additionally been named Simplex representative in the Toledo territory.

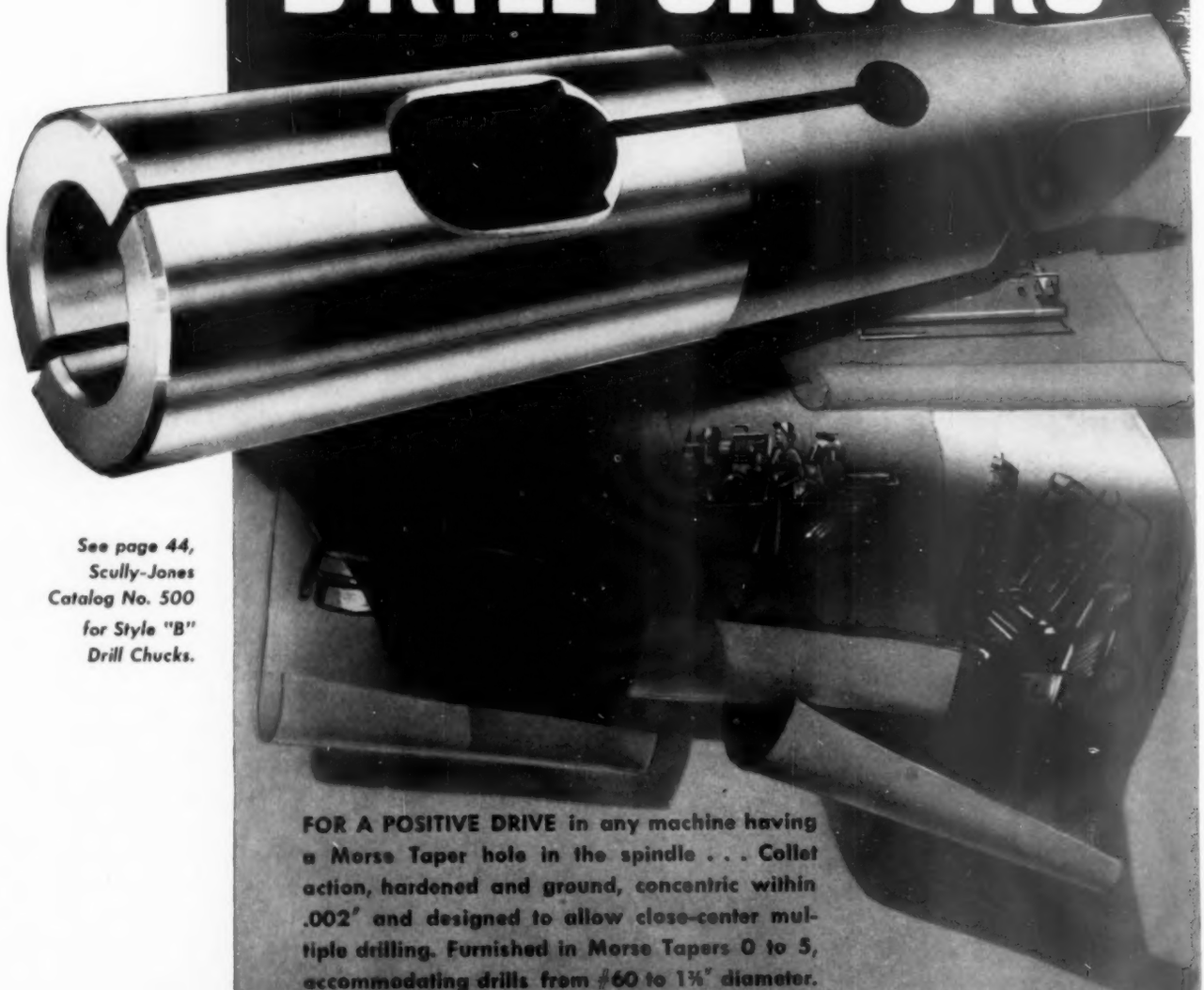
The newly appointed Indiana Sales representative for Simplex is the **State Machinery Co.,** 31 E. Georgia St., Indianapolis, which will also handle the Simplex line of Precision Boring Machines, Planer Type Milling Machines and other special tools.

S. B. KNUTSON has been appointed Gen'l Sup't, *Flexsteel Div'n*, Ambridge, Pa., plant, **Nat'l Electric Products Corp'n,** with **WILLIAM JUNG,** assistant. **W. C. ROBINSON,** President, also announces installation of electro-zinc plating units and modernization of the rolling mills at Flexsteel Div'n.

USE SCULLY-JONES

Style "B"

DRILL CHUCKS



See page 44, Scully-Jones Catalog No. 500 for Style "B" Drill Chucks.

FOR A POSITIVE DRIVE in any machine having a Morse Taper hole in the spindle . . . Collet action, hardened and ground, concentric within .002" and designed to allow close-center multiple drilling. Furnished in Morse Tapers 0 to 5, accommodating drills from #60 to 1⅝" diameter.

Style "B" Drill Chucks are now standard equipment in plants of many leading automobile and airplane manufacturers. Economize by including them in your production tooling setups—for jobs of tomorrow.

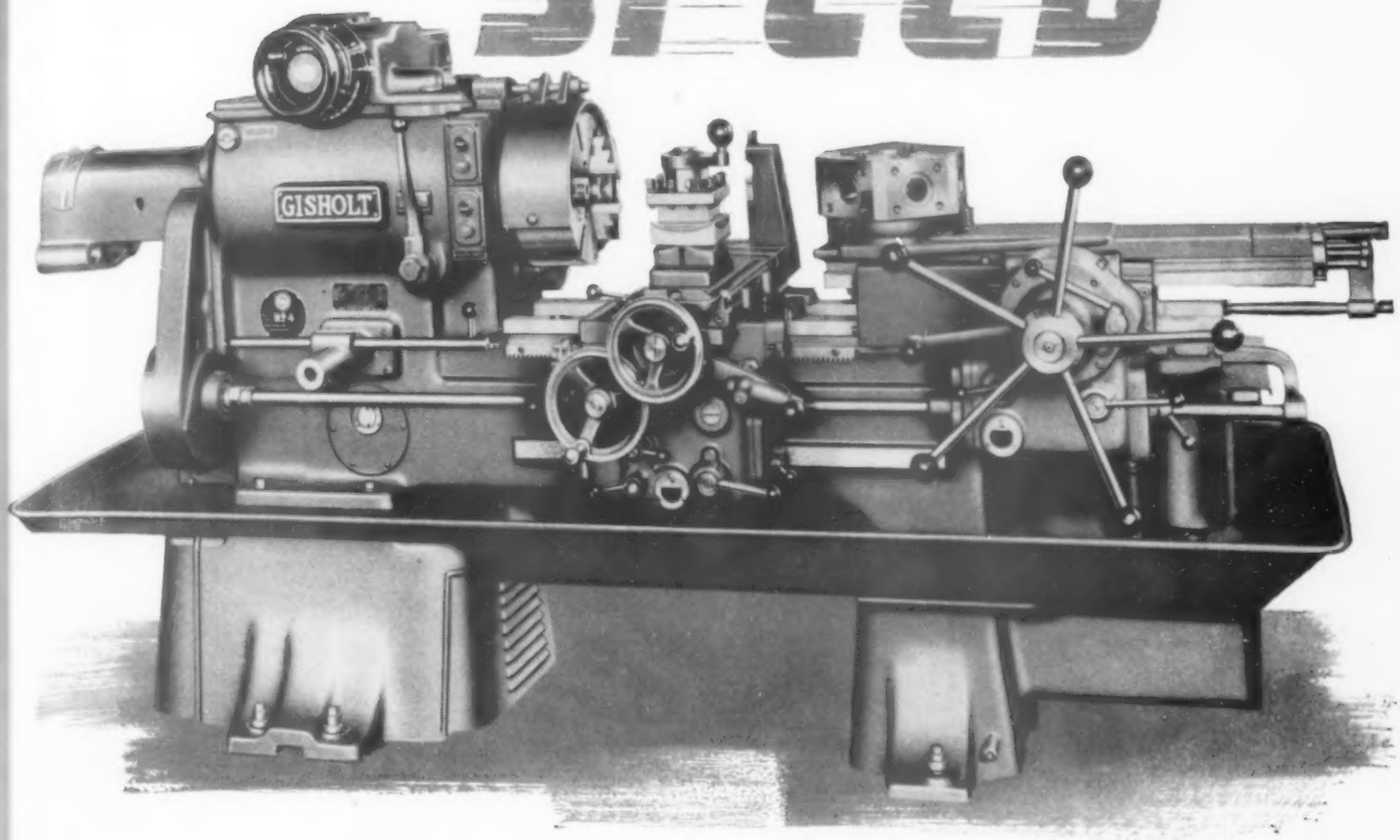
Refer to the Scully-Jones Catalog showing over 300 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Scully-Jones AND COMPANY

1915 SOUTH ROCKWELL STREET ✦ CHICAGO 8, U. S. A.

1980

SPEED



with an easy change of pace to cut machining costs

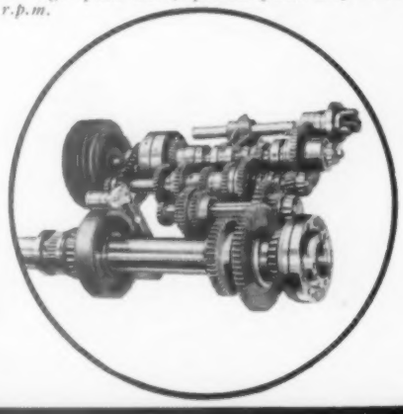
Turret Lathe operation reaches a new high in efficiency in these newest Gisholt Ram Type machines. Whether it's starting, stopping, or reversing the spindle—or shifting gears for any of 12 spindle speeds—it's quick and effortless. It means less time lag between cuts—faster production—lower costs.

And because so little physical strength is required, the fatigue factor is reduced to a minimum. Output is more nearly constant throughout the day.

Speed and lower costs will be more important than ever in the days ahead. Now is a good time to get all the facts.

THE GISHOLT SPEED SELECTOR enables you to indicate the sequence of spindle speeds to be used and then obtain the ideal speed for each cut when you want it, by merely touching a finger trip. Hydraulic power shifts the gears instantly.

12 spindle speeds ranging from 28 to 730 r.p.m. are instantly available in the Gisholt No. 4 Ram Type Turret Lathe shown above. For high speed work, spindle speeds may be increased to 1460 r.p.m.



GISHOLT MACHINE COMPANY

1257 East Washington Avenue • Madison 3, Wisconsin

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GISHOLT

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

G. & L. MACHINE *Completes*

Over 75 Contour Milling . . . Drilling . . . Boring . . . Reaming . . . Tapping . . . Slotting and Back-facing Operations Are Quickly Performed as Casting Is Indexed on Trunnion Type Holding Fixture.

Regardless of intricacy of the workpiece, an almost unlimited range of machining operations can be handled rapidly and accurately on a Giddings & Lewis horizontal boring machine. This unusual and irregular shaped machine component requiring numerous operations is an excellent example of a difficult part, completed on a *standard* G. & L.

More than 75 operations are performed as the part is placed in 9 different positions. A trunnion type holding fixture indexes the different angular surfaces so they are at right angles to the cutters. With this accomplished, it is a simple matter to extend the G. & L. machine spindle and cutting tool to hard-to-reach internal pads, bores, bosses and slides. Over-all machining time including work settings is approximately 33 to 35 hours. Allowable tolerances on most surfaces are plus or minus .001″ and bearing holes are held to .0005″.

Sequence of Operations in Different Work Positions

1st Position — Rough mill face and lineup bosses.

2nd Position — Bore 2 end holes. Open set-up.

3rd Position — Place on angle plate trunnion. Finish bottom face. Drill and back spot face 6 holes.

4th Position — Mill cover plate *(contour milling)*.
Mill cap boss—drill and tap 2 holes for cap.

5th Position — Turn end for end set on 35° angle fixture.
Face mill gear cover box.
Mill cored bearing surface—mill 2″ slot.
Mill 2⅜″ slots.
Drill 7 holes—back spot face 6.
Drill ¾″ hole.

6th Position — Locate on slotted bearing and mill edge—drill and tap 8 holes. Drill and ream 2 holes 65° off cover face.

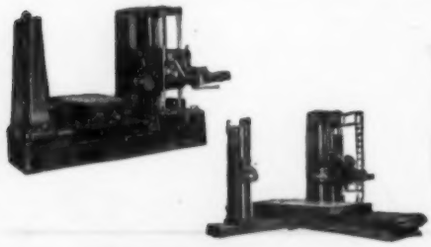
7th Position — Turn end from end.
Counterbore—5¼″ holes.
Bore—2-2.441″ bearing holes.
Bore—1.575″ hole.
Counterbore—2⅛″ hole.
Bore—1.850″ bearing hole.
Mill angular pad inside cover plate.

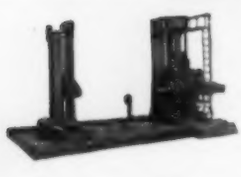
8th Position — Mill gear rack slide on inside 13/16″—¾″—⅛″—.375″ deep.

9th Position — Set on original locating surface and bore center bearing. Index 90° and bore internal bearing.

More Jobs - More Operations - More Profit With a G. & L.

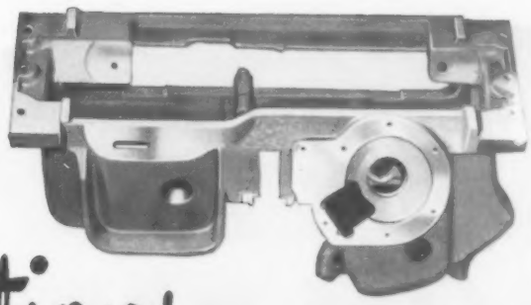
Flexibility and versatility of the Giddings & Lewis Horizontal Boring Machine will enable you to perform more jobs and more operations to increase your machining profits. Giddings & Lewis engineers will gladly show you how to solve difficult machining problems and produce more with standard G. &. L. machines. There is no obligation for this service.





G&L

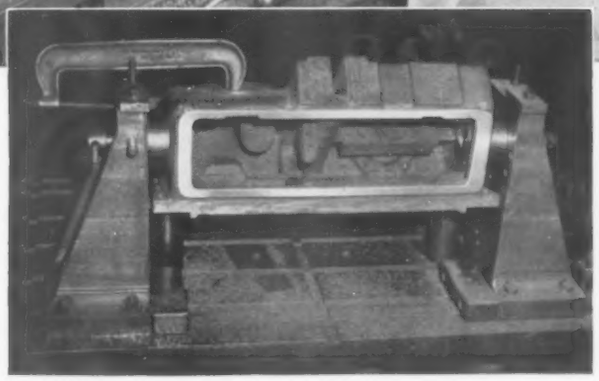
Giddings



all operations ON THIS COMPLICATED PART

Irregular shaped machine part showing a number of operations performed with the Giddings & Lewis machine.

Contour milling the cover plate of an intricate machine part. This operation is performed quickly and easily by using table and headstock feeds to move cutting tool as shown.



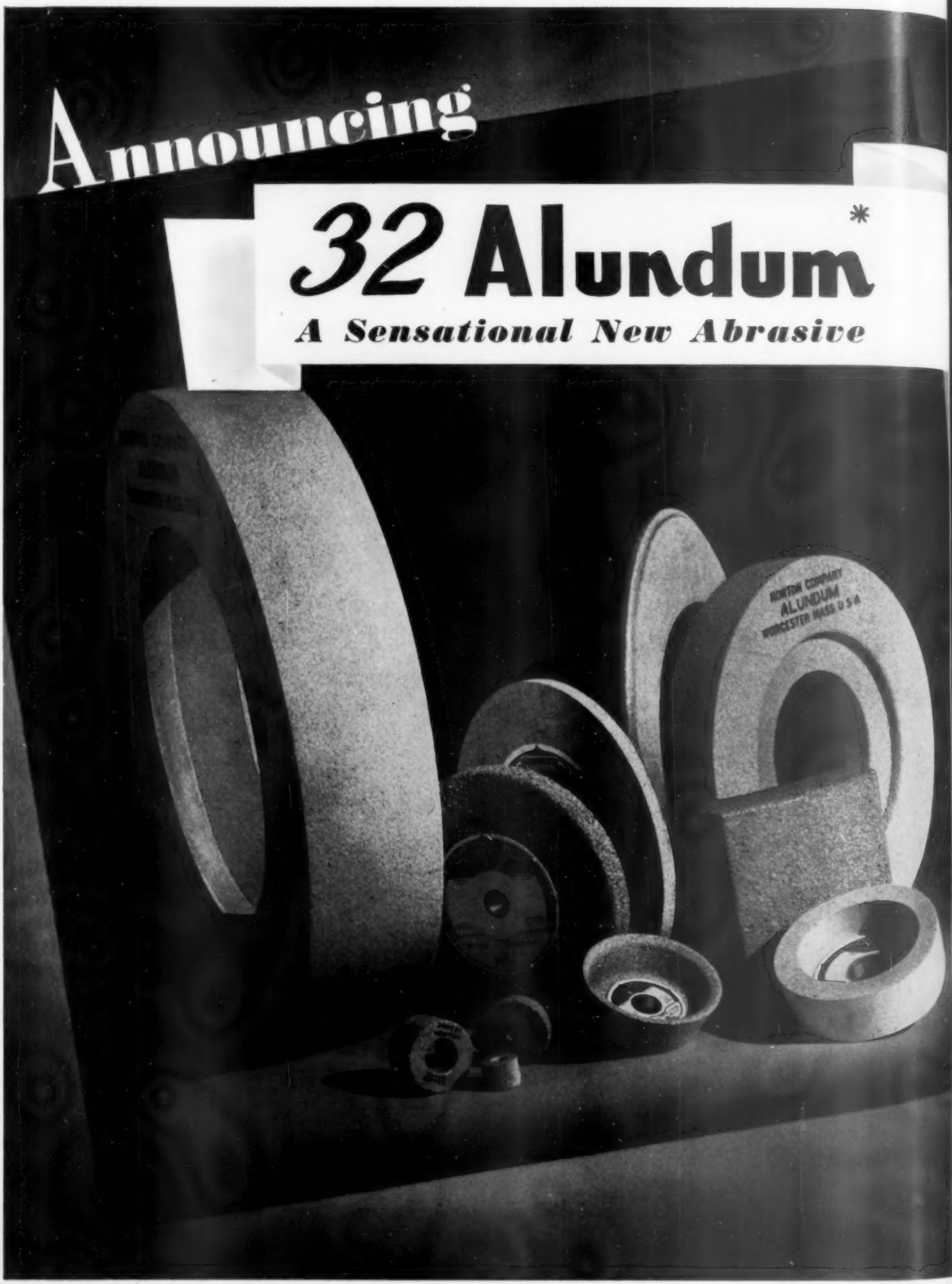
Simple trunnion type holding fixture that indexes angular surfaces correctly for different machining operations.

Helpful
FIELD PERFORMANCE DATA
Free!

Write today for actual field stories showing how many difficult machining jobs are handled on Giddings & Lewis Horizontal Boring, Drilling and Milling Machines. In writing, ask for this valuable information as presented in the Production Data Folder T. E. 106.

G&L Lewis MACHINE TOOL CO.

132 DOTY STREET • FOND DU LAC, WISCONSIN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ALUNDUM
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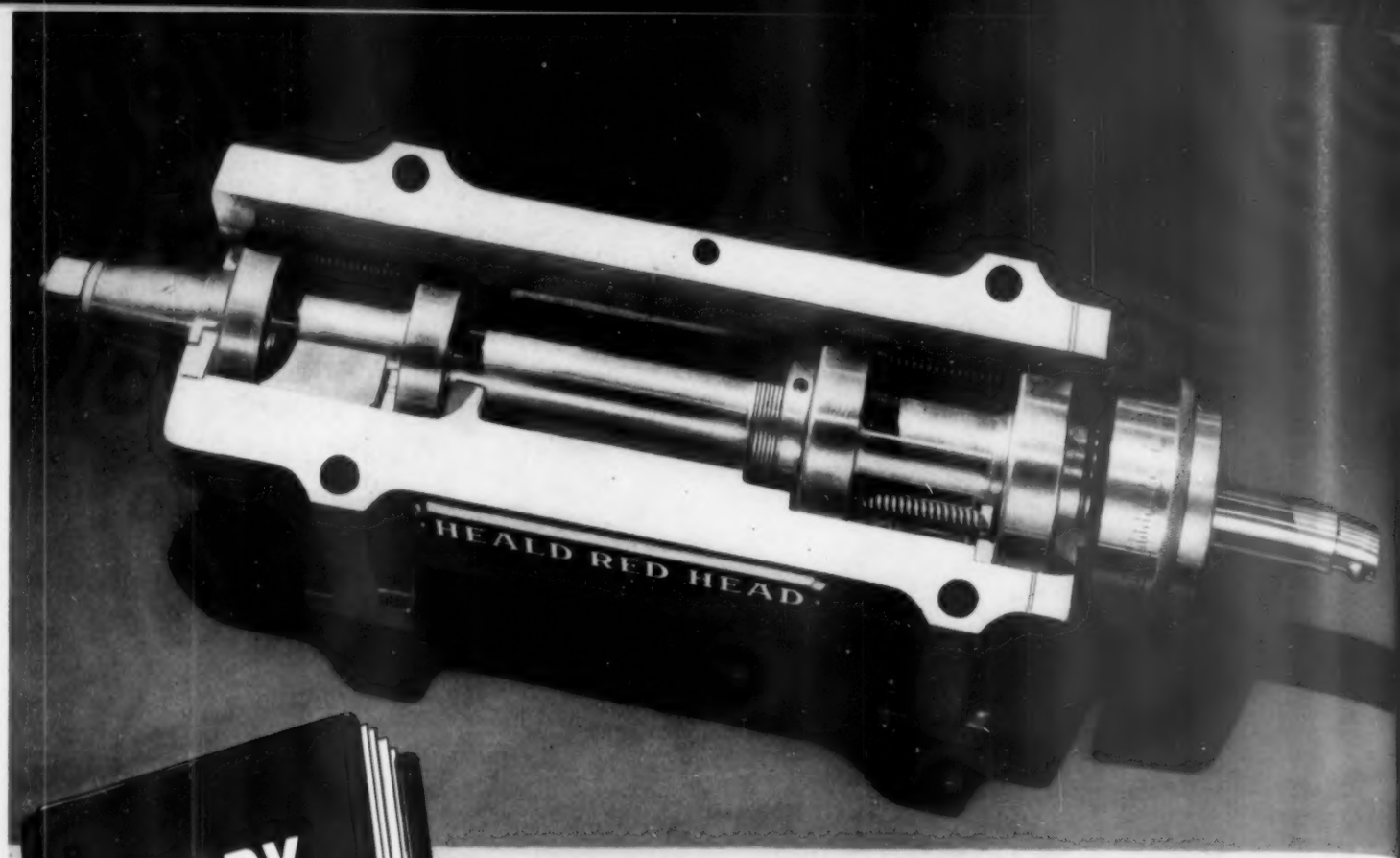

DIARY OF A FAMOUS RED HEAD

BORN

"Red Head" Boringheads and Wheelheads were conceived in the Heald engineering rooms, after many years of experiment by top specialists in machine tool design. The "Red Head" had to be self-adjusting . . . it had to be dependable and foolproof . . . and it had to deliver the very finest in precision finishing. Result: a rugged, serviceable head, soundly constructed and adaptable to every requirement in internal grinding and borizing operations.

VITAL STATISTICS

Cutaway view above illustrates some of the exclusive features of "Red Head" design. Spindle bearings are of the angular contact type, assembled under definite spring preloading which automatically compensates for temperature expansion or contraction and wear. Oil flow to the bearings is regulated by individual felt wicks. Close-fitting baffles exclude dirt and water.

SERVICE RECORDS

The Heald "Red Head" has earned a reputation for doing its job—whether it be high speed operation rotating grinding wheels or tools, or carrying heavy work fixtures—with a minimum of maintenance and with the utmost in precision efficiency. Here are some actual "Red Head" service records from our files:

- **22,000 hours' service—in production 24 hours a day.**
- **6 years' production—no bearing replacements or repairs.**
- **24-hours-a-day production for 3 years maintaining perfect condition.**
- **8⅓ years' operation—36,420 hours' service.**
- **In continuous operation for 10 years—still using the original boringhead bearings.**
- **32 Bore-Matics with over 100 Heads in one plant—only one required bearing change.**
- **45 Bore-Matics in another plant—some in continuous operation for 8 years without boringhead trouble.**

Records like these, common among "Red Head"-equipped Heald machines, result in quicker set-ups, fewer delays, less down time—factors that may well mean the difference between profit and loss in your machining work. Whatever the size of your shop or the scope of your work, chances are that the "Red Head" and the men who designed it can help to give you faster, more economical production. For further information, write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

means more precision

. . . less cost

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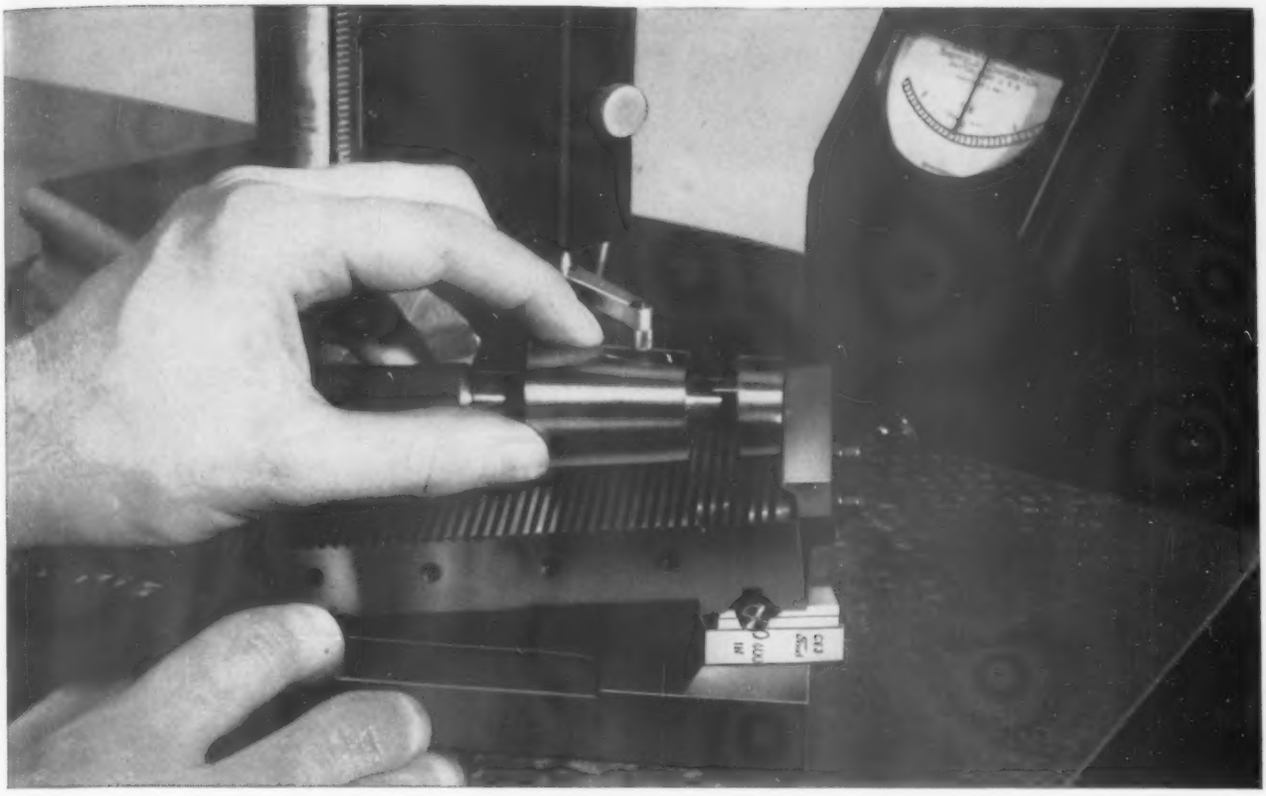

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BETHLEHEM

Tool Steel Reference List

Bethlehem tool steels range from the straight-carbon types to the highly-alloyed, special-purpose grades so often required in modern practice.

Broadly speaking, the standard Bethlehem tool steels come under seven main headings. The following list is a general guide, and it includes the steels for almost every job in your plant:

	CLASSIFICATION	TYPE ANALYSIS	TRADE NAMES
1.	General-Purpose Tool and Die Steels *(water-quenching)*	C or C-V 0.70 to 1.40 carbon range	X; Best; XCL; Superior; XX
2.	Safe-Hardening Tool and Die Steels *(oil-quenching)*	Mn-Cr-W-V Ni-Cr-Mo	BTR Bethalloy
3.	Air-Hardening Tool and Die Steels *(air-quenching)*	Mn-Cr-Mo	AH; AH-5
4.	High-Production Tool and Die Steels	High C, High Cr	Lehigh L; Lehigh H; Lehigh S
5.	Shock-Resisting Steels	Si-Mn W Cr-V	No. 71 Alloy; Omega No. 67 Chisel Tough (H and M tempers)
6.	Hot-Work Steels	Cr-Mo W	Cr-Mo-W; Cr-Mo-V No. 57 Hot Work; No. 57 Special Hot Work
7.	High-Speed Steels	W W-Mo	Bethlehem Special High Speed; Comokut; Red Tiger (Improved) 66 High Speed; Moco; HM

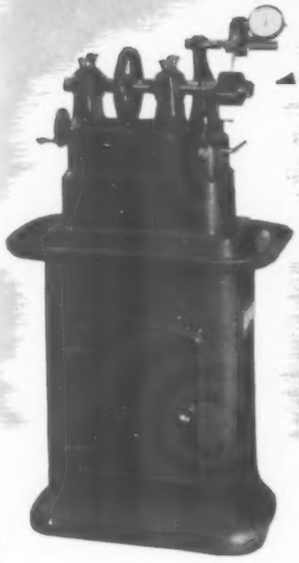
Remember, our specialists are always ready to talk applications with you. Call us when tool-steel problems get tough—or better still, let us work with you from the start.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Bethlehem tool steels for every purpose

BETHLEHEM STEEL



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MEASURING HOB TOOTH PROFILE

CHECKING HOB AFTER SHARPENING

Flawless Performance

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ILLINOIS MEASURING MACHINES

The building of metal cutting tools of unsurpassed quality requires not only skilled workmanship but infinite care in inspection procedures. To safeguard its reputation for quality, Illinois Tool Works developed ILLINOIS Measuring Machines—checking equipment that has become renowned and adopted by industry for unexcelled quality control. It is this kind of engineering that backs each product of the Illinois Tool Works.

Illustrated above left to right: ILLINOIS Hob Lead Measuring Machine, ILLINOIS Hob Tooth Profile Measuring Machine and the ILLINOIS Cutter Sharpening Tester.

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In the first place, your own experience quickly narrows the field to a relatively few wheels from which the final choice is made. And, it is in making this last decision where more and more top drawer production men depend on the advice and suggestions of an abrasive specialist.

Your CARBORUNDUM representative is always prepared to offer competent assistance in selecting grinding wheels that give better grinding at minimum cost. His thorough analysis of your grinding operations provides a dependable double check on their efficiency. Often, he can offer a practical suggestion for improvement. For he is fully aware of the latest developments in abrasives and their application. What is more, his very business brings him in daily contact with a variety of modern grinding jobs. Where the problem is especially difficult or involved, he can call in one of our Abrasive Engineers. If necessary, the facilities and resources of the world's best known abrasive laboratories are available. You receive cooperation that assures you of getting the most out of your grinding operations and abrasive wheels when you call in CARBORUNDUM.

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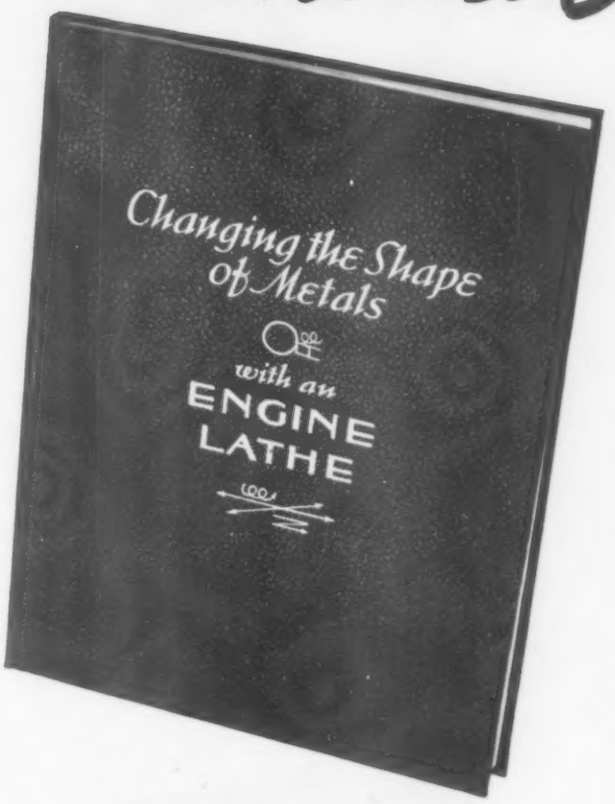

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This book is the only one of its kind to combine, in one volume, the information that will bring managers, supervisors, operators, instructors, and beginners up-to-date on the complete function of all types of engine lathes.

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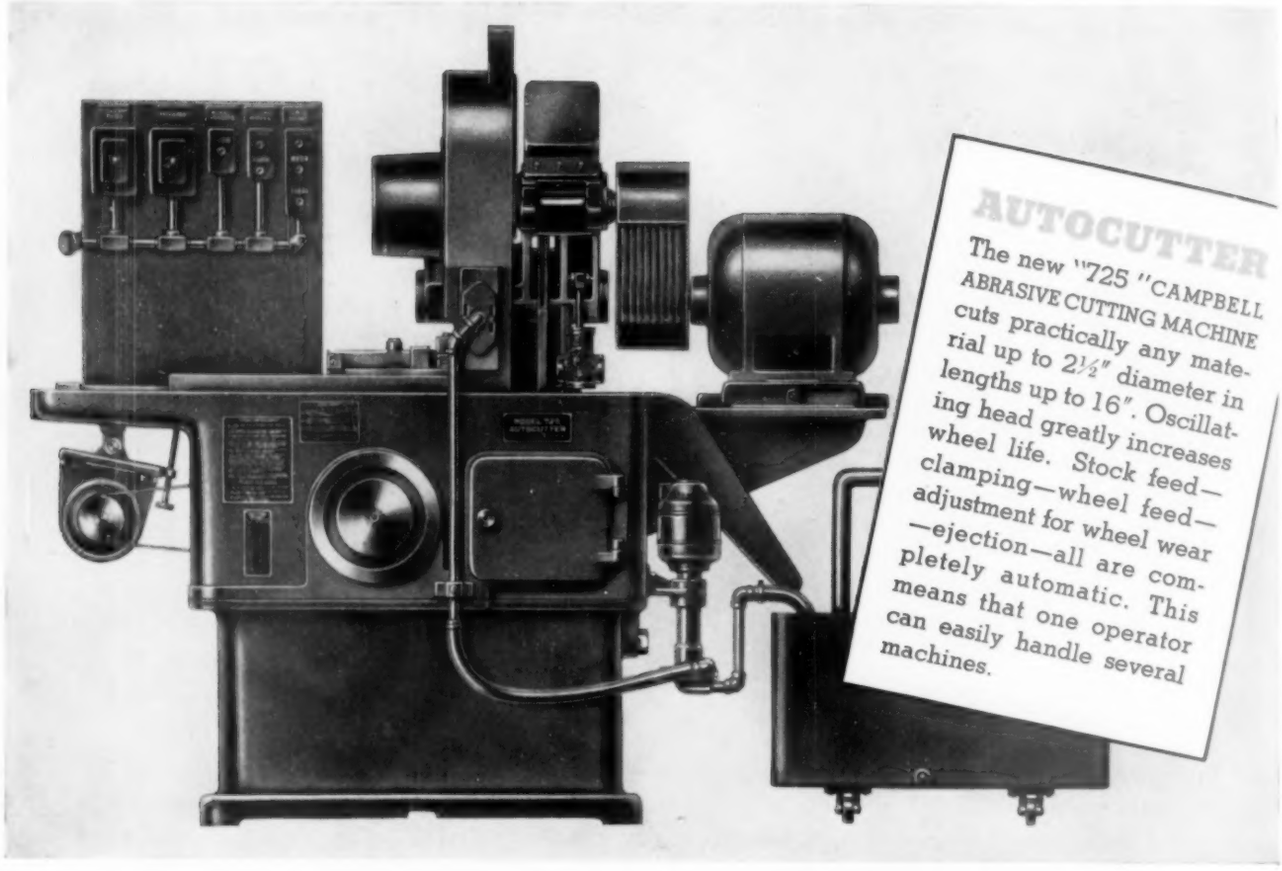

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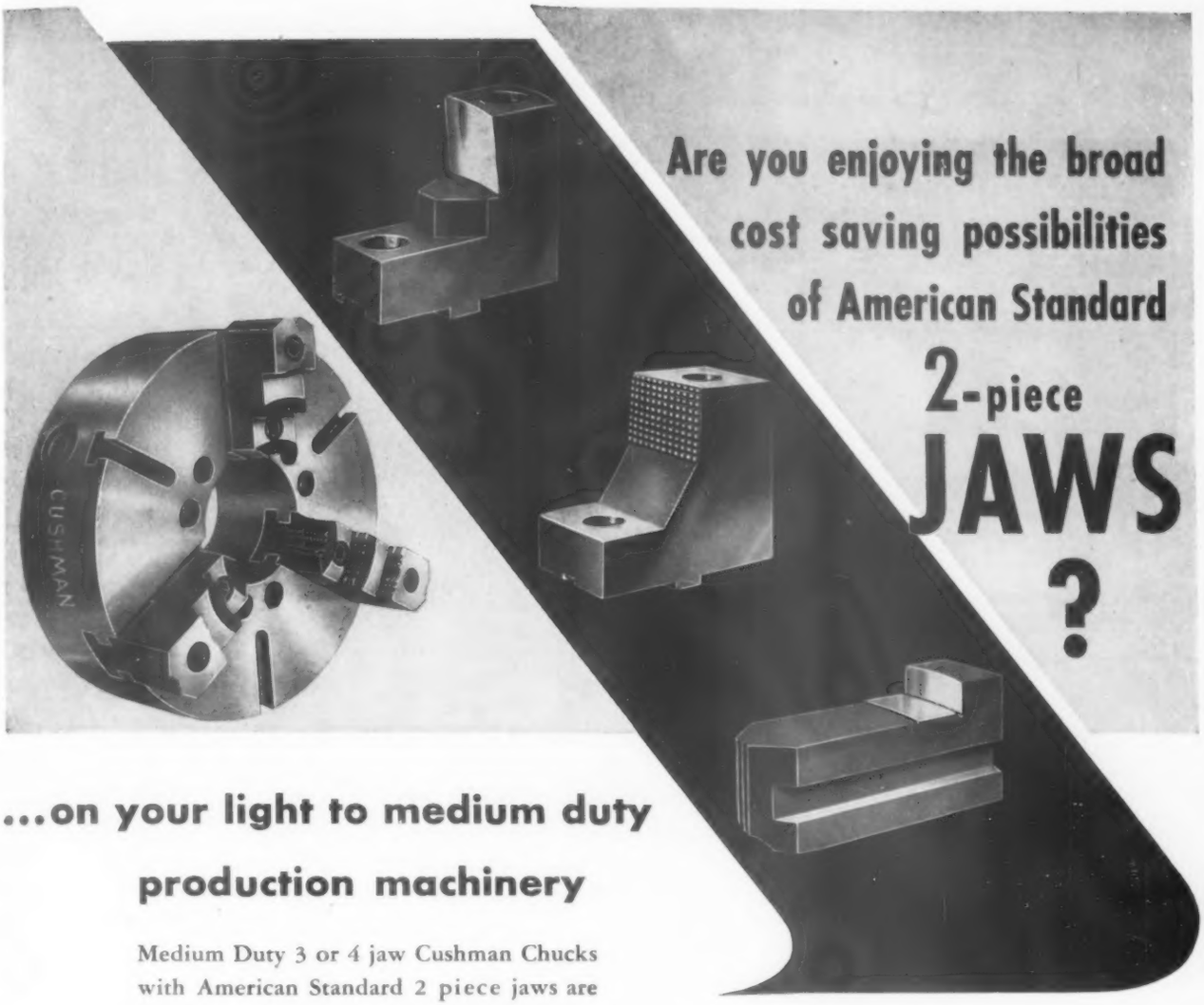

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Medium Duty 3 or 4 jaw Cushman Chucks with American Standard 2 piece jaws are the ideal equipment for your tool room lathes, your general purpose lathes and the great majority of lathes in your production departments. Because, with this type of jaw, you remount the top jaws when changing from one form of work piece to another... rather than using expensive work holding fixtures.

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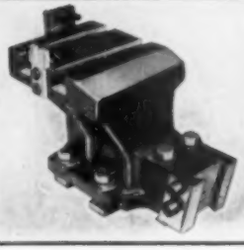
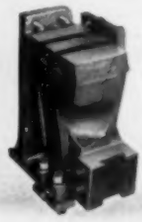
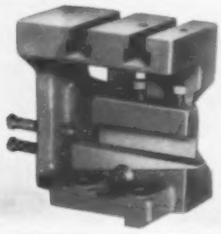


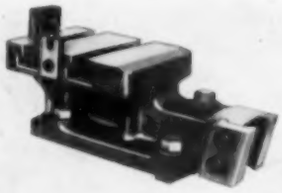
Double deck dovetail form tool holder for Acme-Gridley.



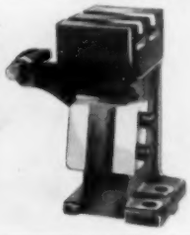
Double deck dovetail form tool holder for F or G Gridley.



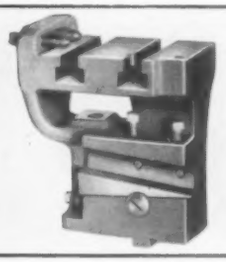
Double deck flat form tool holder for front position on F or G Gridley.



Double deck dovetail form tool holder for Acme-Gridley.

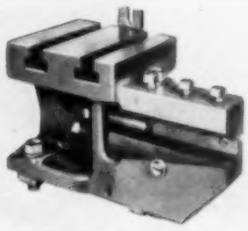


4th position double deck dovetail form tool holder with 3rd position cut-off for F or G Gridley.

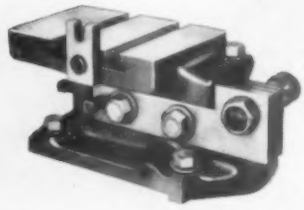


Double deck flat form and cut-off tool holder for F or G Gridley.

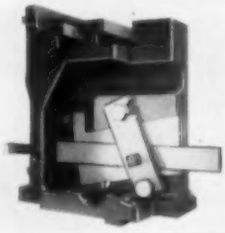
Double deck cut-off and shave tool holder for F or G Gridley.



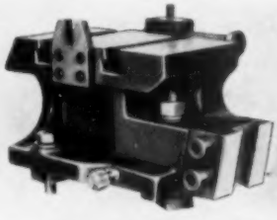
Double deck flat form tool holder for all Acme-Gridley.



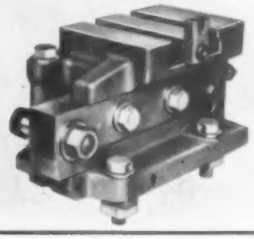
Double deck circular form tool holder for Gridley and Acme-Gridley.



Double deck flat form tool holder for front position on 1¾ to 2⅛ inch F or G Gridley.



Double deck dovetail form tool holder for Acme C Automatics.



Double deck circular form tool holder for Gridley and Acme-Gridley.

SLITTER'S TOOL HOLDERS *MEET ALL YOUR REQUIREMENTS*

The double deck tool holders shown here are but a few of the 400 items which comprise the SLITTER line of standard automatic screw machine tool holders. Included in our complete line are flat form, dovetail, and circular forming tool holders for C Acme, F or G Gridley, Acme-Gridley, New Britain Gridley, Greenlee, and Cone automatics. The selection is so wide and varied that you will find our standard holders capable of meeting 90% of all your requirements.

That is the reason why many owners have standardized on SLITTER tool holders. They like their versatility and adaptability.

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DETROIT 7, MICHIGAN

Increased Productivity

WILL BRING PRODUCTION COSTS DOWN

TWO-WAY FLEXIBILITY

WILL BRING EQUIPMENT COSTS DOWN

Cars will cost less! . . . especially when the need for Increased Productivity makes its full impact upon the public's consciousness. And, day by day, this conviction grows, among the executives and workers in the mass production field . . . the surest way—and the safest!—to a sounder industrial economy is through Increased Productivity.

One means to that end is by use of the Baker 30 HH Horizontal Multiple Operation Machine, pictured above. Engineered for multiple drilling and multiple rough and finish reaming six holes on the flange end of automotive crankshafts, this machine is Baker's contribution to Increased Productivity. It features, among other improvements, push-button control and automatic cycling, thus insuring ease of operation and more pieces produced per hour.

Baker two-way flexibility brings cost-cutting advantages, too. *First*, multiple head unit design with pick-off gears, provides varying speed to spindles for flexibility of operation. *Second*, individual, six-spindle heads, mounted at three cutting stations, make for quick and inexpensive replacement to meet future changes in location of the hole centers in the part.

Flexible design and high productivity are features of all Baker machines. Let us recommend ways to increase production on your difficult machining jobs.

HERE'S THE WAY WE LOOK AT IT

Increased Productivity is most important, but what we impersonally call the "human element" is still our first consideration. We design all our machines to aid the operator to increase his productivity and improve the quality of his work . . . with less effort . . . because we know that Increased Productivity is the surest way to better jobs—and job security for everyone.

Baker Bros., Inc. TOLEDO 10, OHIO

Tools That Have Helped to Make Automotive History

PRECISION MACHINES **PM** PARKER · MAJESTIC

Since 1907, the name of Parker has been a part of the progress of the automobile industry.

In 1915, Parker introduced the basic principle of ball bearings in grinding manufacture—a major advance in grinding which was unknown at that time.

A few years later the Parker Ball Bearing was patented to meet high speed and precision requirements and has been in use ever since.

Further research and engineering development brought forth the well-known Parker Majestic External and Internal Grinding Machines, each machine representing a great advance in simplicity of operation and precision.

The latest tooling development of the company is the Parker Majestic No. 2 Surface Grinder that provides new accuracy and flexibility for small grinding operations.

These many products of Parker Majestic will continue to serve the great automotive industry in the future, keeping pace with its demands for speed, accuracy and dependability.

MANUFACTURED BY

MAJESTIC TOOL AND MANUFACTURING COMPANY

147 JOS CAMPAU • DETROIT 7, MICHIGAN

Brown & Sharpe Spiral End Mills cut *FASTER*, more *FREELY* and require *LESS POWER*

Hollow face and angle of rake

Produced by a generating process which reduces the danger of grinding burns, these edges cut more pieces per sharpening. The angle of rake reduces power consumption.

Correct number of teeth

Tooth design permits use of fewer teeth which increases cutting efficiency and enables teeth to be made much stronger with greater chip space.

Stronger teeth

The use of a double angle land, giving the desired cutting clearance without danger of the heel of the land rubbing on the work, makes these stronger teeth practical.

Correct helix angle

Two types of helix angle provide smooth cutting action . . . a small helix angle for teeth of two lipped spiral end mills for accurate milling of slots and a steep helix angle for teeth of both regular and two lipped end mills for smooth, fast-cutting action on general milling work.

Fine design features and skilled manufacture give these end mills the qualities essential for fast production. The clean-cut chips with little discoloration – not compressed – not misshapen–are visible evidence of clean cutting action – ability to take many cuts between sharpenings with a long cutter life. Brown & Sharpe End Mills will produce more work for you at lower cost. Write for literature. BROWN & SHARPE MFG. CO., Providence 1, R. I., U.S.A.

B·S

We urge buying through the Distributor

BROWN & SHARPE CUTTERS

FINE FINISH from a ROUGH GRINDER?

ON THIS HANCHETT *Certainly!*

SINGLE SPINDLE DISC GRINDER

They needed a heavy-duty, all-purpose grinder to surface rough castings. That's why Viloco Machine Company, Benton Harbor, Mich., chose a Hanchett No. 8 Single Spindle Disc Grinder as the best on the market for the job.

But it didn't take long to find out that their Hanchett was more than a rough grinder — and now they get high production on precision work like that described at right.

Steel, cast iron and alloy steel are ground on Hanchett Disc Grinders with satisfying results. Why tie up your large high precision grinders with jobs these rugged machines will handle at a lower overall finishing cost? They're built in a wide range of sizes with work tables to fit your specific requirements.

THE JOB: Grinding steel disc inserts for gate valves. These polished inserts are cast integral with the body, leaving inside faces as smooth as machined surfaces. Ground smooth with fine finish, otherwise seat would wear causing valve failure.

THE SOLUTION: Using a simple workholder, operator averages 75 finished inserts per hour, maintaining close tolerance throughout.

NOTE: Since the spindle of the Hanchett No. 8 carries grinding wheels on both ends, a second operator rough and finish grinds disc seats for ¾" to 6" valves at the same time! Here tolerances of .0005" are held, yet production averages 80 units per hour. No fixture needed.

See your nearest Hanchett dealer or write for Bulletin 145-ITJ for detailed information.

HANCHETT GRINDERS — BIG RAPIDS MICHIGAN

IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

HANCHETT MANUFACTURING CO.
BIG RAPIDS, MICHIGAN U.S.A.

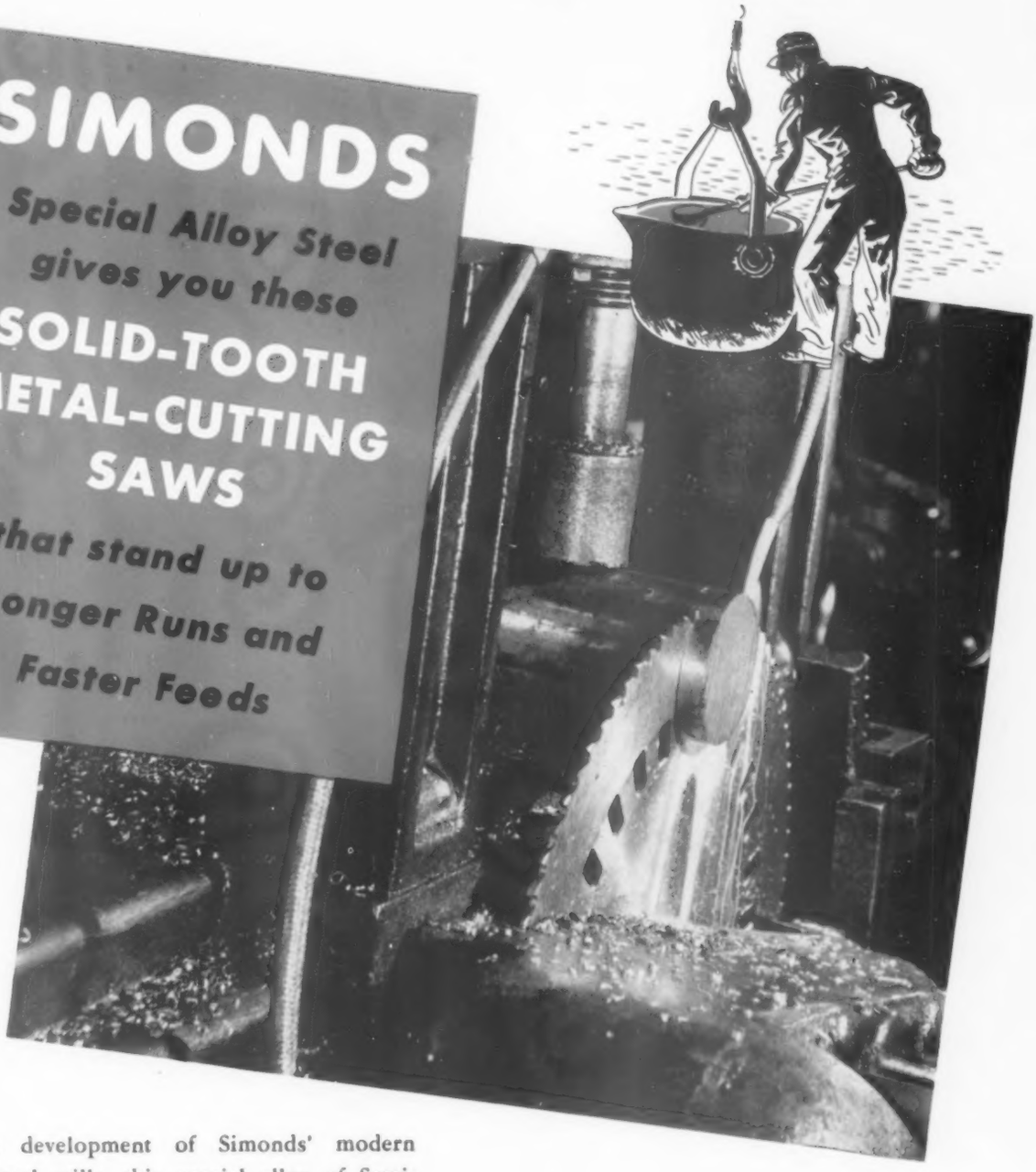
HANCHETT HERMETI-COIL MAGNETIC CHUCKS

SIMONDS

Special Alloy Steel gives you these

SOLID-TOOTH METAL-CUTTING SAWS

that stand up to Longer Runs and Faster Feeds



Exclusive development of Simonds' modern electric steel mills, this special alloy of Semi-High-Speed Steel gives you longer runs at faster feeds . . . on a wide range of work from mild steel and cold-rolled shafting to high-speed and chrome nickel steels.

Another exclusive Simonds process is the method of grinding side-clearance . . . a method which produces Solid Circular Saws with uniformly accurate rim-thickness. Then the saws are finished by still another special process which leaves no hammer-marks on the plate.

These exclusive advantages are *your triple warranty* of longer life and plus-performance in Simonds Solid-Tooth Circular Metal-Cutting Saws. Order them from your Industrial Supply Distributor or from the nearest Simonds office.

SIMONDS SAW AND STEEL CO.

FITCHBURG, MASS.

Other Divisions of SIMONDS SAW AND STEEL CO. making Quality Products for Industry

SIMONDS STEEL MILLS
SIMONDS SAW AND STEEL CO.
LOCKPORT, N. Y.
Special Electric Furnace Steels

SIMONDS ABRASIVE CO.
PHILADELPHIA, PA.
Grinding Wheels and Grains

SIMONDS CANADA SAW CO. LTD.
MONTREAL TORONTO VANCOUVER SAINT JOHN, N.B.
Simonds Products for Canada

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S.W. First Avenue, Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

Over One Million feet of precision threads with just six cutters!

Part: Large adaptor plug.
Material: SAE 1035.
Thread Diam.: 4″ and 6⅜″ on each piece.
No. of Threads: 8 and 10 respectively. (12 pitch)
Tolerance: ± 0.005 in. (on pitch diameter)
Quantity: 50,000 pieces.
Output: 15 parts per hr. per machine. (16 hrs/day)
Tools Required for Run: Only 6 "Detroit" thread milling cutters.
Average No. of Grinds: 18 per Cutter.
Stock Removed per Grind: .015 to .020 in.

Those are cold figures but to the tool engineer and production man they tell a real cost-saving story—the kind of performance needed today to keep costs down—the kind of performance "Detroit" thread milling cutters are giving day in and day out.

Those "Detroit" cutters were just as good as new even after 18 sharpenings apiece.

What's more, "Detroit" thread milling cutters are easy to order. Most widely used types and sizes are even carried in stock, ready for thread grinding to your specs.

Ask for Bulletin No. CB-45

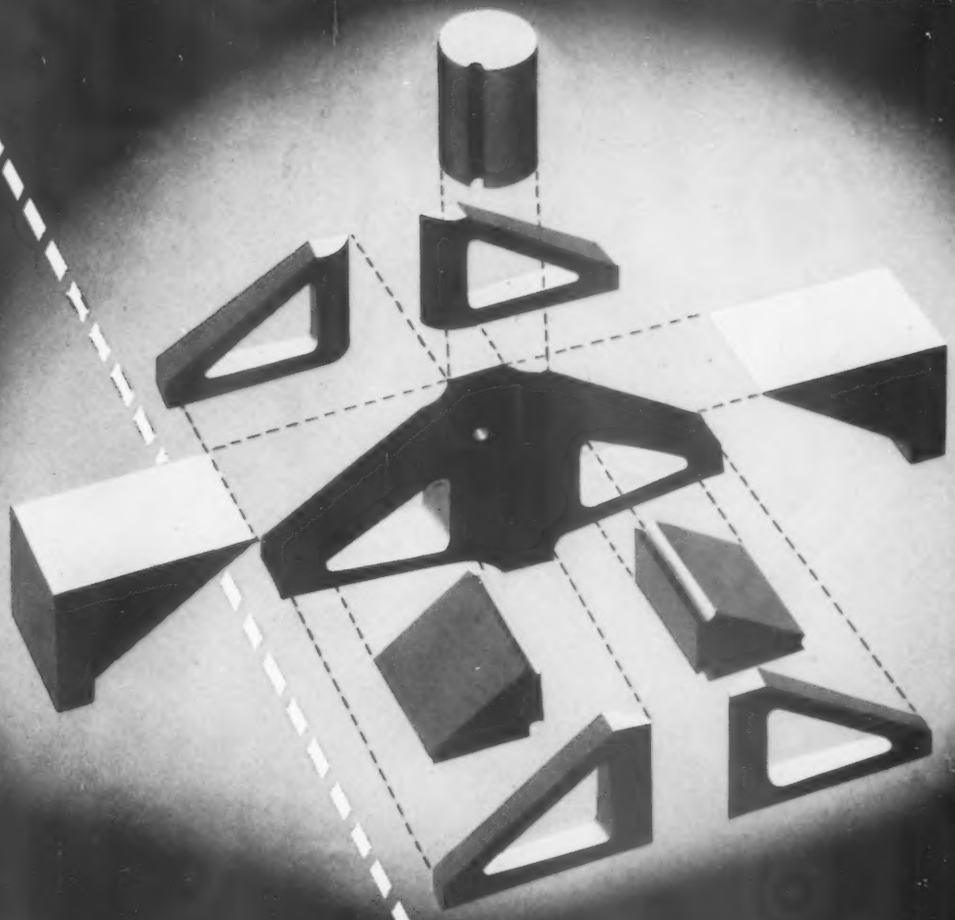
• Ground Taps • Tap Reconditioners •

DETROIT TAP & TOOL CO.
8432 BUTLER AVE. • DETROIT 11, U.S.A.

• Thread Gages and Special Threading Tools, Machines and Checkers •

DoALL

MIRACLE METHOD OF LOW-COST PRODUCTION



fast "slicing" *not* slow "whittling"

World's Fastest Metal-Removing Process

Countless production parts sliced to shape and size in minutes—not hours or days as with other processes. Contour Sawing leaves only a 1/16" kerf—does not waste time "whittling" metal to worthless chips. Smooth power at infinitely varying speeds moves an endless band edged with razor-sharp, superhard teeth—untouchable with a file! Cutting is continuous—no wasted backstroke. Does internal as well as external cutting through tough steel up to 30" thick.

Endless applications in production, maintenance and toolroom work. A finished "casting" is cut faster than making drawings and patterns, besides saving time of casting and machining. Write for "DoALL Equals Ten Plus" which pictures advantages of Contour Sawing.

DoALL

SHELDON Vernon

Now Available!

See the new SHELDON MACHINE tools at Space No. A183 National Metal Congress Atlantic City November 18 to 22

Coming off the new production lines in Chicago, the SHELDON-built SHELDON-Vernon Precision Machine Tools* are now available at the same moderate prices that made them first in the moderate priced field. Built in the new modern SHELDON plant which is equipped with every advanced machine tool building facility, they are better than ever—even more accurate, more rugged and better finished.

Lighter and smaller and less costly than machine tools of equal accuracy, they provide a faster, more convenient and economical means of doing all but the heaviest operations.

Write for Bulletin on:

***SHELDON-Vernon Horizontal Milling Machine**

***SHELDON-Vernon Vertical Milling Machine and Jig Borer**

***SHELDON-Vernon 12″ Shaper**

Builders of Good Lathes Since 1919

SHELDON MACHINE CO. Inc.

Manufacturers of Sheldon Precision Lathes • Arbor Presses • Vises
Sheldon-Vernon Horizontal Milling Machines • Vertical Milling Machines and Jig Borers • Shapers

4229 N. KNOX AVENUE • CHICAGO 41, ILLINOIS, U. S. A.

ONE TOOL SET-UP
tells the story!

Prove it yourself!

All you need to do is tool up *one* machine with Improved TECO Cemented Carbide on any carbide job. Then check it against your best production record . . . for pieces produced . . . number of grinds per tool . . . tool life . . . tool cost. Practically every plant that has tried Improved TECO Cemented Carbide on this basis, reports production far beyond any results every obtained.

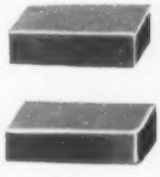
Top production has been a habit of TECO Cemented Carbide for many years. Now, new manufacturing methods and advanced controls give the Improved TECO much higher degrees of uniformity, hardness, toughness, thus greater resistance to wear and breakage.

Why not make this simple, convincing trial? Send us details of your job set-up, or request one of our tool engineers to call. Meanwhile, our latest catalog and price list are available on request.

TUNGSTEN ELECTRIC CORPORATION
570 39th Street, UNION CITY, N. J.
Branch Office: 403 Western Reserve Bldg., Cleveland 13, Ohio
Representatives: Indianapolis, Ind., Detroit, Mich.

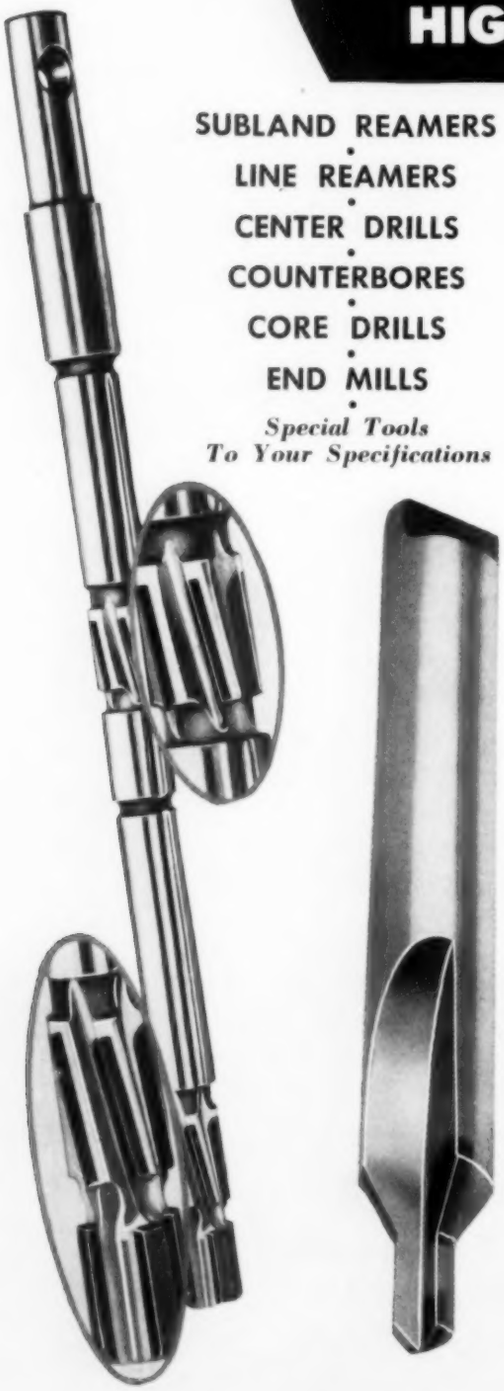
Improved
TECO
CEMENTED CARBIDE

IMMEDIATE DELIVERY
on full range of standard sizes and styles of both Tools and Blanks



Now!

CARBIDE-TIPPED TOOLS
BRAZED OH HARDENED
HIGH-SPEED STEEL BODIES



SUBLAND REAMERS
•
LINE REAMERS
•
CENTER DRILLS
•
COUNTERBORES
•
CORE DRILLS
•
END MILLS
•
Special Tools
To Your Specifications

AGAIN, Detroit Reamer & Tool Company sets the pace in metal cutting tools, with brazed carbide tips on hardened high-speed steel bodies, so that the total length of the flutes and pilots will Rockwell C-62-63.

It has also been proven in actual practice that this type of tool has a higher cutting efficiency due to the harder background for the carbide tips which produces less "spring-back" under heavy cuts for this same reason. Also, the flutes and pilots will not "score" or pick up due to the hardness of the high-speed steel and long wear on the pilot.

All of these outstanding advantages, together with longer tool life and reduced production costs, are at your disposal with Carbide Tipped Cutting Tools, with HIGH-SPEED STEEL BODIES.

• **MADE TO YOUR SPECIFICATIONS** •

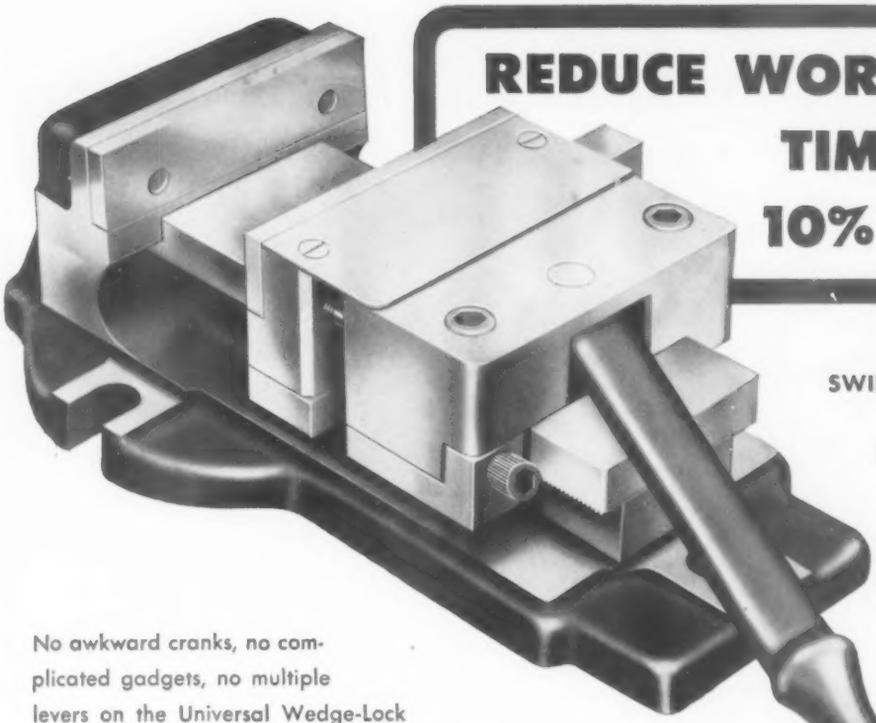
Write for QUOTATION

DETROIT REAMER & TOOL CO.

2830 E. Seven Mile Road **Detroit 12, Michigan**

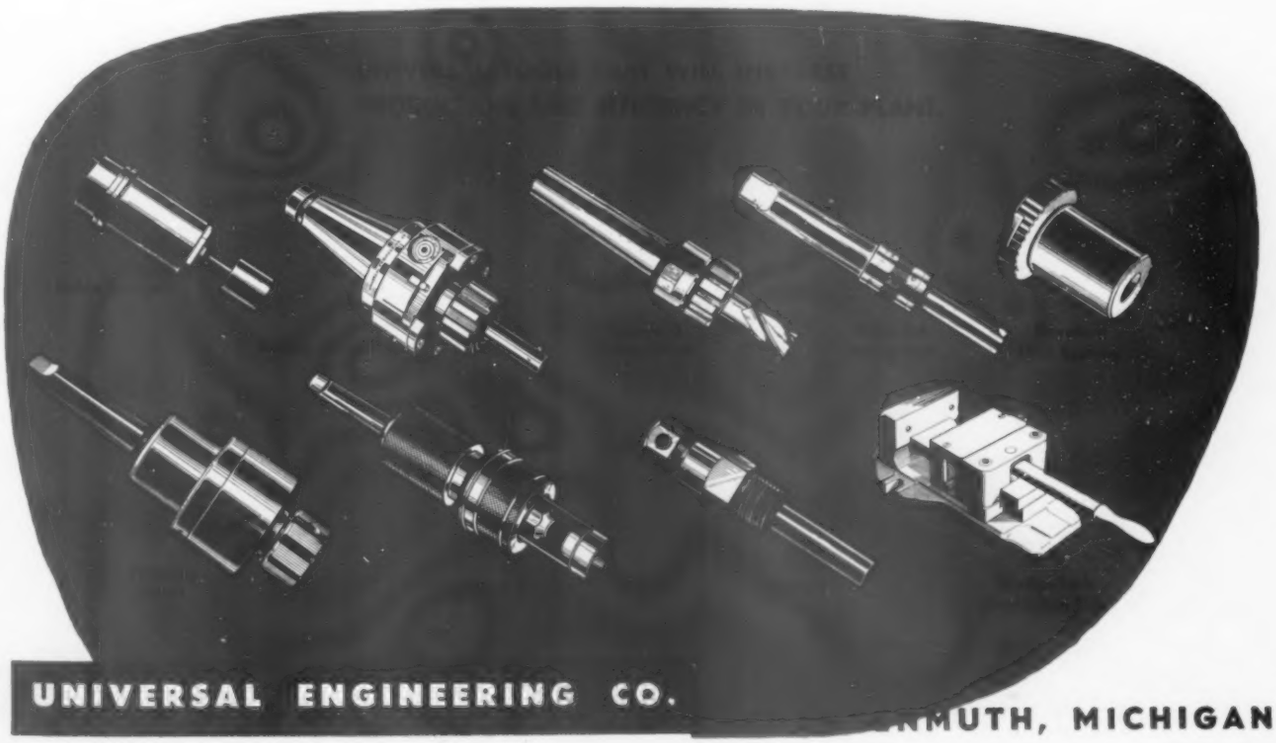
Manufacturers of Oil-Hole Drills, Subland Drills, Special Reamers, Circularity Relieved Reamers, End Mills and Special Tools

REDUCE WORK CHANGE TIME FROM 10% TO 80%



SWIFT LOCKING, POSITIVE GRIP OF NEW UNIVERSAL WEDGE-LOCK VISE SIMPLIFIES SMALL PARTS PRODUCTION

No awkward cranks, no complicated gadgets, no multiple levers on the Universal Wedge-Lock Vise. A short 7 degree pull on the locking lever handle clamps work securely, ready for milling, drilling, tapping, or other production operations. Pressure is applied smoothly, evenly, and quickly through taper wedges to adjustable jaw. On production jobs this speed and positive locking slashes work change time 10% to 80%, permits machine operator to load vise with one hand and lock with the other. Jaw widths 3", 4", 5", and 6". Write for complete information.



UNIVERSAL ENGINEERING CO. **...NMUTH, MICHIGAN**

HAVE YOU TRIED MO-MAX COBALT?

HIGH SPEED STEELS

Whenever your cutting tools are operating under such severe conditions that a cobalt high speed steel is desirable, specify MO-MAX COBALT. It is available in four distinctive types, two with 5.00% cobalt and two with 8.00% cobalt.

If your regular sources cannot make prompt delivery on MO-MAX COBALT, we shall be glad to direct you to an available source of supply. In writing, please describe the proposed application.

Full information will be found in the MO-MAX Handbook. See Pages 27-28.

Buyer's Guide to Brands of MO-MAX

"LMW"	Allegheny Ludlum Steel Corp.
"MOHICAN"	Atlas Steels Limited
"BETHLEHEM HM"	Bethlehem Steel Co.
"MO-CUT"	Braeburn Alloy Steel Corp.
"STAR MAX"	Carpenter Steel Company
"MOLITE M-I"	Columbia Tool Steel Co.
"REX T-MO"	Crucible Steel Co. of America
"DI-MOL"	Henry Disston & Sons, Inc.
"HI-MO"	Firth-Sterling Steel Company
"REX T-MO"	Halcomb Steel Company
"MOGUL"	Jessop Steel Company
"TATMO"	Latrobe Electric Steel Co.
"MIDMAX"	The Midvale Co.
	St. Lawrence Alloys, Inc.
"S. T. M."	Simonds Saw & Steel Co.
"MO-TUNG"	Universal-Cyclops Steel Corp.
"8-N-2"	Vanadium-Alloys Steel Co.
"VUL-MO"	Vulcan Crucible Steel Co.

ONLY MO-MAX GIVES YOU *all* THESE ADVANTAGES

1. MO-MAX has superior cutting qualities. It is a happy combination of great toughness with high hardness.
2. The machinability of MO-MAX is unexcelled, particularly in grinding.
3. MO-MAX is economical. Its specific gravity is about 8% less than that of 18% tungsten steel. Thus for the same weight of high speed steel, 13 bars of MO-MAX are obtained as compared with 12 similar bars of an 18% tungsten steel.
4. In addition to the standard general-purpose composition of MO-MAX high speed steel, several special types have been developed for particular purposes. There are four with a high cobalt content, one high in vanadium and two that are especially suitable for hot die work.
5. MO-MAX was the first of the modern molybdenum high speed steels. For 13 years MO-MAX has demonstrated its superiority in cutting tools.

★ ★ ★

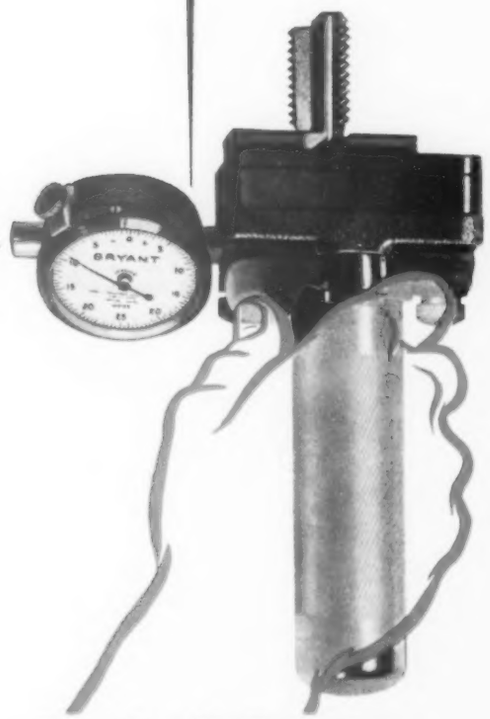
Send for your copy of the MO-MAX Handbook, sixth edition. Get the full story about this remarkable steel, including easy-to-follow instructions on heat treating.

THE CLEVELAND TWIST DRILL COMPANY • 1242 East 49th Street • Cleveland 14, Ohio

Another BRYANT Postwar Development

The new Bryant Portable Thread Gage offers a faster, more accurate inspection method for checking internal threads in large castings or parts still chucked in the machine. *It is the only gage which quickly and visually indicates internal thread size with master gage precision.* A glance at the large dial indicator immediately shows accumulated inaccuracies of pitch, lead, thread form and diameter or presence of burrs. The new portable — constructed on the same principle as the proven Bench model — is faster, simpler, and constantly accurate. There's no tedious threading, no feeling for fit, and none of the rapid taper wear that is encountered with conventional gages.

The new Bryant Portable Thread Gage brings to every corner of your plant a modern, foolproof, time-saving method for internal thread gaging. It will cut your inspection costs to a new low while adding speed to your production line. Write today for new bulletin giving complete details.



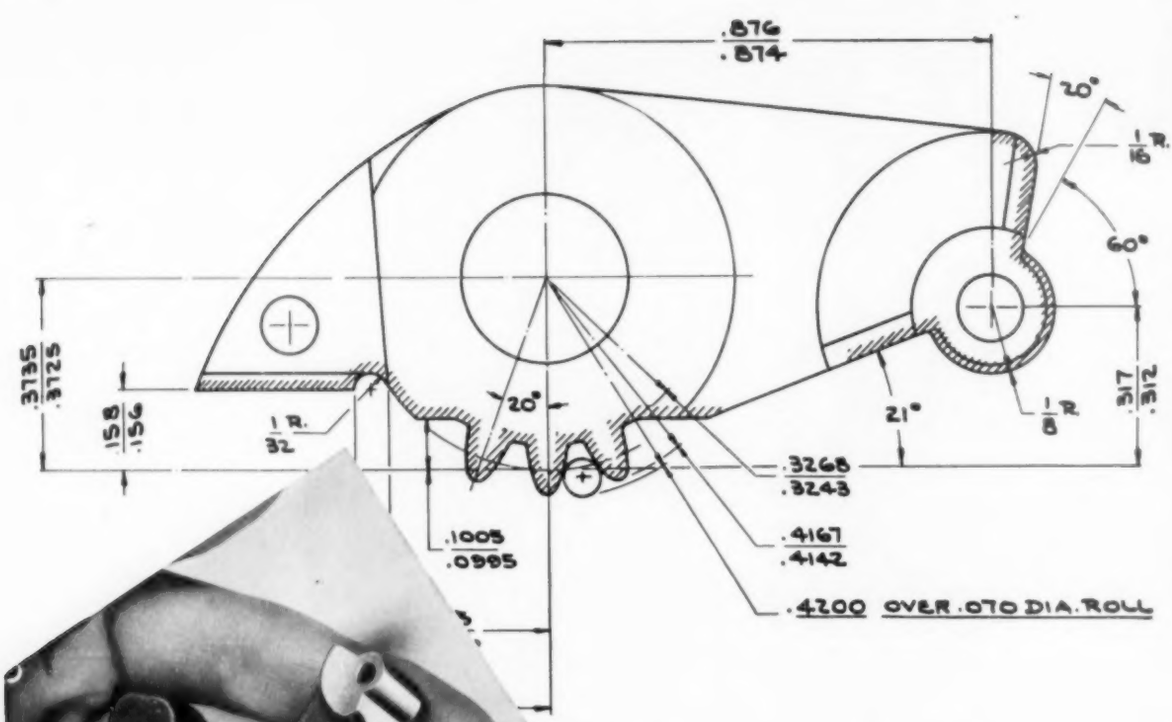
Bryant Portable Thread Gage

Also Universal Diameter Gage, Squareness of Face Units, Adjustable Thread Gage

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

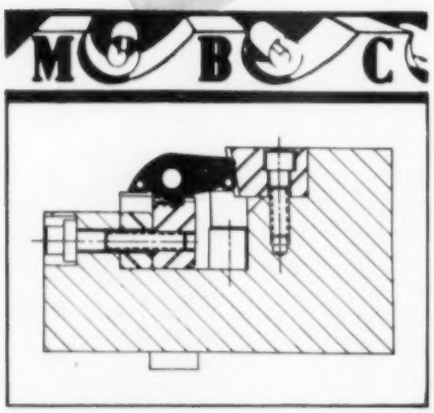


What's so different about *this* part?

Just this—The job was engineered—the tools were built and the part was machined by ONE SOURCE, MICHIGAN BROACH.

This same "*complete service*" is being performed daily for many customers and being performed at reduced costs. MICHIGAN'S "know how" in *designing, building* and *using* broaches makes this possible.

MICHIGAN, long recognized as one of the industry's most reliable sources for broaches, fixtures and gages, also operates the largest commercial machine shop of its kind in the country for *furnishing complete parts.*



Four milling operations were required to machine this contour. It was broached in one operation. Broaching is faster, reduces scrap, requires less skilled labor.

Send your next part to MICHIGAN for machining or have MICHIGAN quote on furnishing it complete.

The new NUMBER 8 folder is off the press. Write for your copy. It deals with an interesting phase of broaching.

MICHIGAN BROACH CO.

10367 NORTHLAWN AVENUE **DETROIT 4, MICHIGAN**

First Quality Tool Steels

for every service

What we mean by First Quality

In anything, *first quality* means the finest possible material—excellence of character—the highest standard of excellence—natural superiority.

In Vanadium-Alloys Tool Steels, *first quality* means *known* and *proved* superiority in uniformity, in soundness, in composition, in grain size, in hardenability and in toughness. It's little wonder that Vanadium-Alloys Tool Steels have earned the reputation with tool steel buyers of being the "Tiffany" of tool steels—the finest that money can buy.

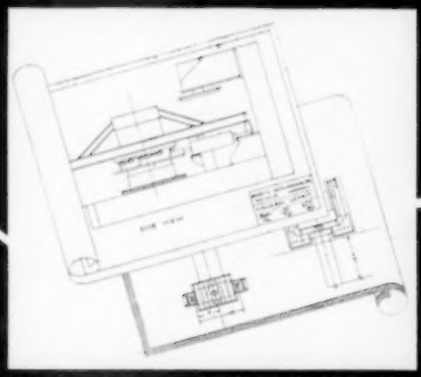
Vanadium-Alloys Steel Company

First Quality Tool Steels

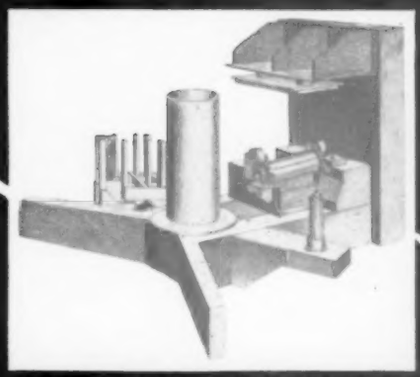
Latrobe, Pennsylvania

COLONIAL STEEL DIVISION . . . ANCHOR DRAWN STEEL CO.

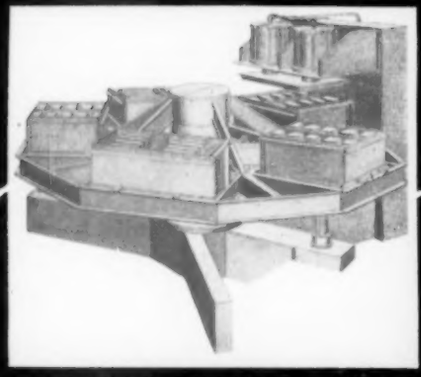
From Start to Finish



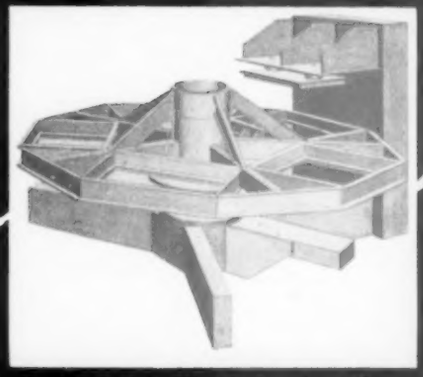
1. The idea is conceived and completely engineered by our Engineering Division. Our Production Illustration Department then produces illustrations showing each step for major assembly.



2. The next step is taken by the Production Engineering Division who plans the manufacture, and designs the necessary jigs, tools, and fixtures for assembly.



4. The product is then assembled through the various stages shown on this page, with the constant coordination of the Engineering Division and Production Engineering Division.



3. The Manufacturing Division then draws the necessary materials and parts from the Production Control Division, and begins work on the project.

5. By following thorough engineering and the straight line organization principle, we are able to produce the product from blue print to complete project within a minimum of time.

A good example of our "Production thru Engineering" is the Hi-Production Concrete Block Machine, which is shown on this page.

Any project the firm of Henry & Hutchinson, Incorporated undertakes is carried out with the same thoroughness illustrated by the steps outlined on this page. Any inquiry relative to the details or various phases of the work we can do will be promptly answered.

Production thru Engineering

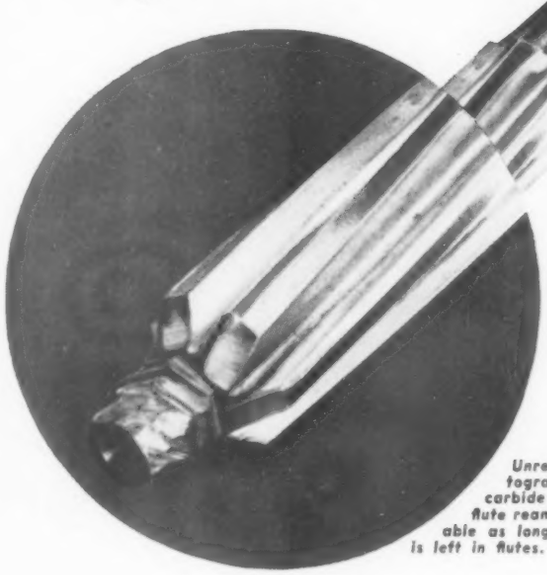
HENRY & HUTCHINSON, INC.

DECATUR (ATLANTA) GEORGIA

PRODUCTION ILLUSTRATORS **TOOL PLANNERS** **PRODUCTION ENGINEERS**

This WENDT-SONIS REAMER

- REGROUND 51 TIMES — STILL IN USE
- AVERAGED 18 HOLES BETWEEN GRINDS — EXTRA HEAVY CUTS



Unretouched photograph of W-S carbide tipped spiral flute reamer. Still useable as long as carbide is left in flutes.

production data report . . .

NAME: Halliburton Oil Well Cementing Co., Duncan, Okla.

WORK: Reaming hole 4½" in depth in 4130 steel — Rockwell C Hardness 41 to 43 — on a radial drill.

TOOLS: 1. H.S.S. Reamer was used first and could not do the job satisfactorily.
2. Wendt-Sonis Carbide Reamer.

SPEED: 450 to 500 rpm.

FEED: .010.

RESULTS: 900 holes on 51 regrinds to average 18 holes between grinds.

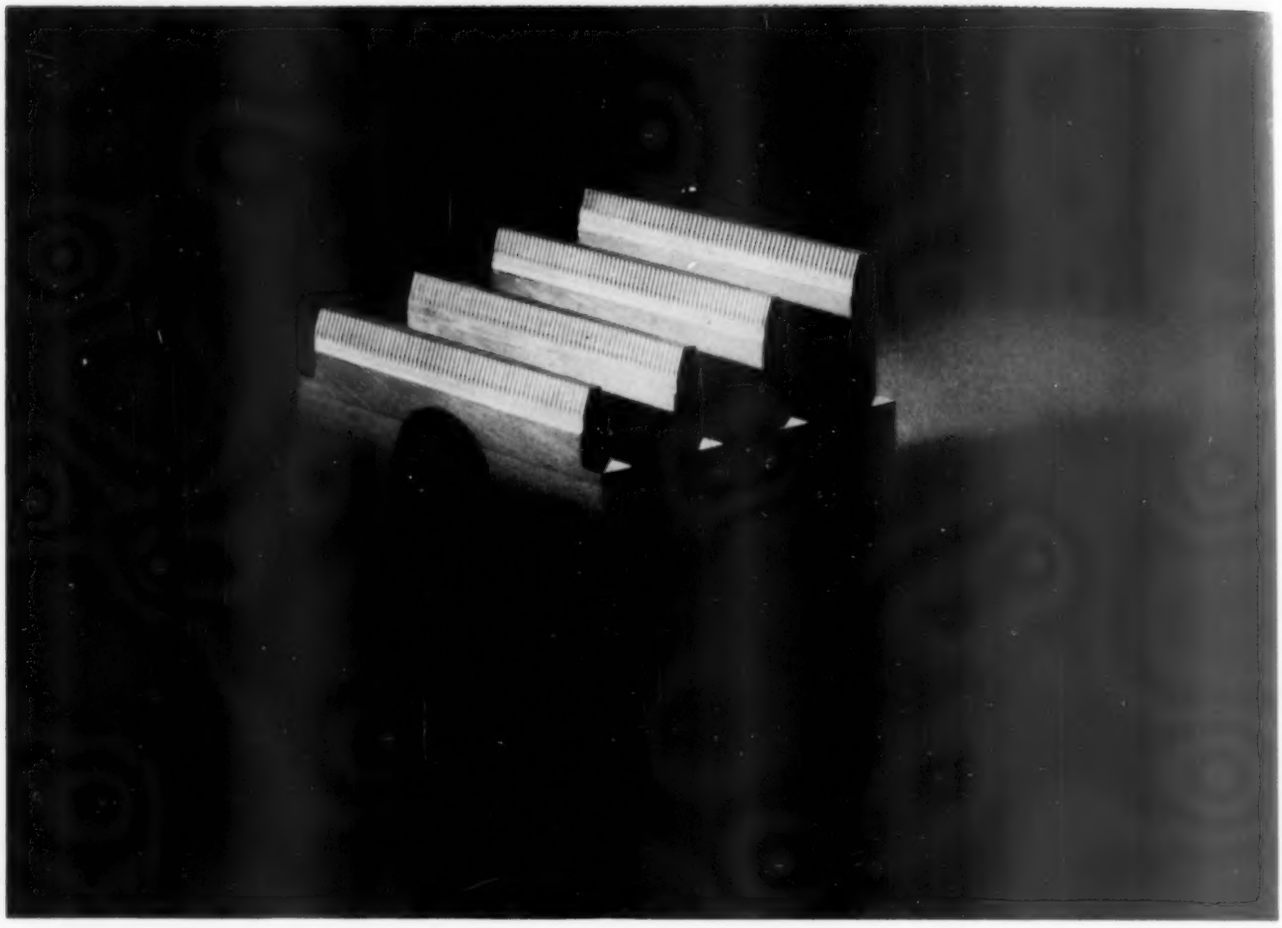
Performance records like the one described above are ample proof that Wendt-Sonis Reamers help increase production . . . decrease costs. And, new developments continue to lengthen the service life of these reamers. Wendt-Sonis carbide-tipped reamers are made in a wide variety of sizes and styles — designed by one of the pioneers in the carbide tool field.

HELP ON YOUR CUTTING TOOL PROBLEMS is available through a nation-wide sales and service organization WENDT-SONIS CO., Hannibal, Missouri and 580 North Prairie Avenue, Hawthorne, Calif.

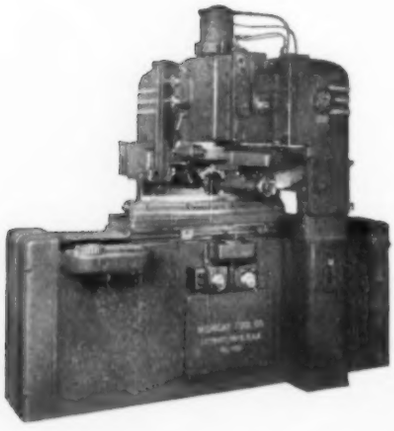
WENDT SONIS

CARBIDE CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS
FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL BITS



"TOOL COST LESS THAN 1/2 CENT PER GEAR FINISHED"



That is the story of a typical MICHIGAN rack type gear finisher. On this rack about one and one-quarter million gears were finished. About 40,000 gears were produced per sharpening—an "average" performance figure for rack type shavers. The rack was sharpened eight times before requiring re-serrating. It was re-serrated four times—giving a total of 32 sharpenings.

Above are shown four rack blades representing the history of this rack. At the right, a new blade is shown. At left, after the last re-serration—still good for 320,000 helical (9.25 Pitch) gears.

Where high production of accurate gears is the order of the day, there is no substitute for the MICHIGAN 900 rack type shaver as to tool cost per piece.

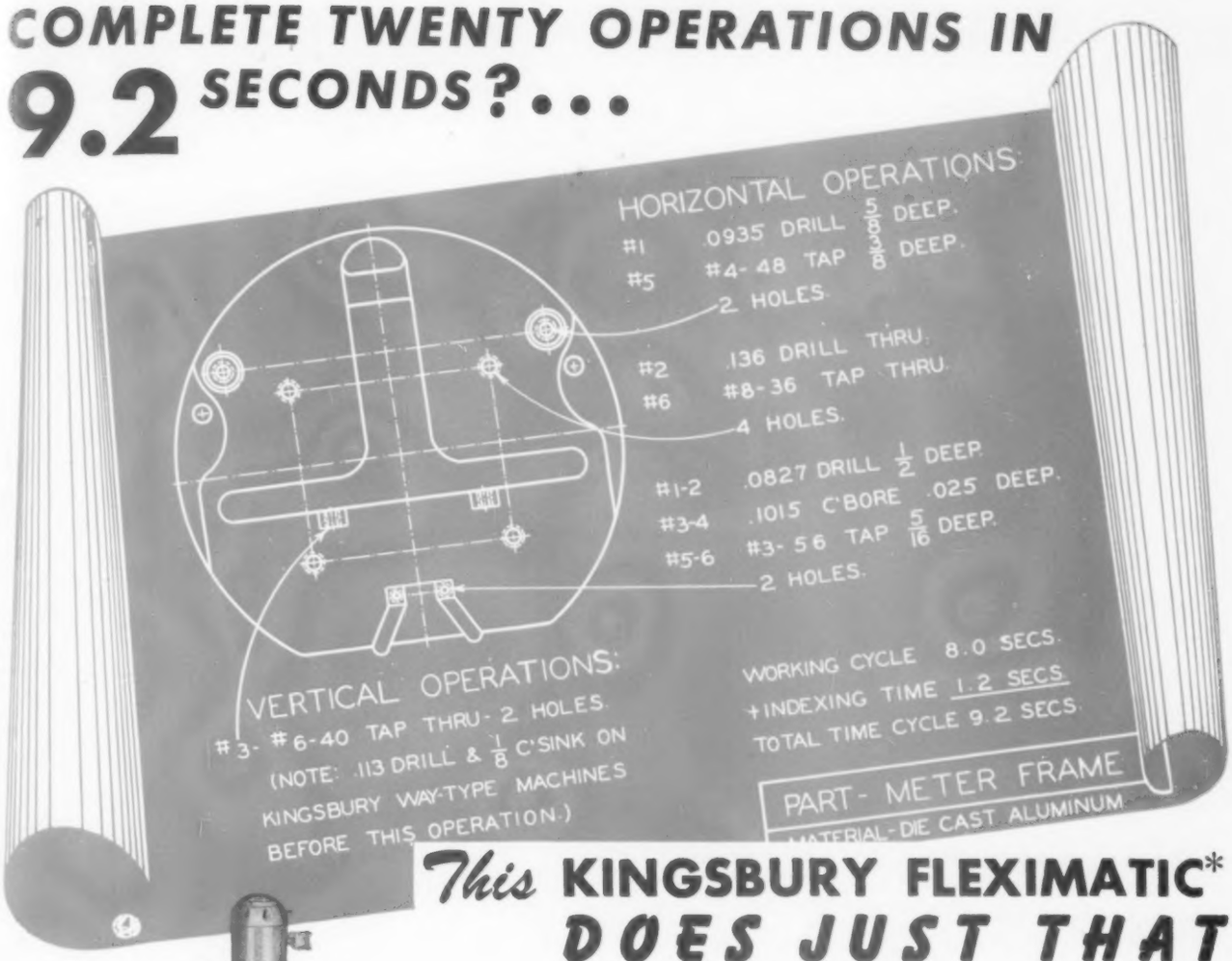
For further information, write for Bulletin #900-45.

ORIGINATORS of GEAR SHAVING

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.

COMPLETE TWENTY OPERATIONS IN 9.2 SECONDS?...


HORIZONTAL OPERATIONS:
#1 .0935 DRILL 5/8 DEEP.
#5 #4-48 TAP 3/8 DEEP.
2 HOLES.
#2 .136 DRILL THRU.
#6 #8-36 TAP THRU.
4 HOLES.
#1-2 .0827 DRILL 1/2 DEEP.
#3-4 .1015 C'BORE .025 DEEP.
#5-6 #3-56 TAP 5/16 DEEP.
2 HOLES.
VERTICAL OPERATIONS:
#3-#6-40 TAP THRU-2 HOLES.
(NOTE: .113 DRILL & 1/8 C'SINK ON KINGSBURY WAY-TYPE MACHINES BEFORE THIS OPERATION.)
WORKING CYCLE 8.0 SECS.
+INDEXING TIME 1.2 SECS
TOTAL TIME CYCLE 9.2 SECS.
PART - METER FRAME
MATERIAL - DIE CAST ALUMINUM

This KINGSBURY FLEXIMATIC* *DOES JUST THAT*

In one chucking this Kingsbury Fleximatic automatically drills, taps, and counterbores a meter frame as shown in the sketch. Each part is chucked in one of seven identical work holders on the indexing turret. As soon as the turret has indexed and locked, the seven automatic head units start their work cycle. While they are operating on six parts, the operator removes the completed piece from the seventh work holder and replaces it with a new part. Thus, the time to complete each piece is the time for the longest single operation plus the brief indexing interval.

Because the base, the indexing turret, and the head units are all standard Kingsbury equipment, the initial cost is far lower than the usual special purpose machine. This unit construction also simplifies the problem of adapting a Fleximatic to a change in design of the part.

Kingsbury Fleximatics have reduced the machining cost of hundreds of different parts requiring multiple operations up to an inch or more in diameter. Send us samples and prints of your high production jobs specifying the operations and production desired and also the locating point. We shall make proposals without obligation.

KINGSBURY
MACHINE TOOL CORP.
KEENE, NEW HAMPSHIRE

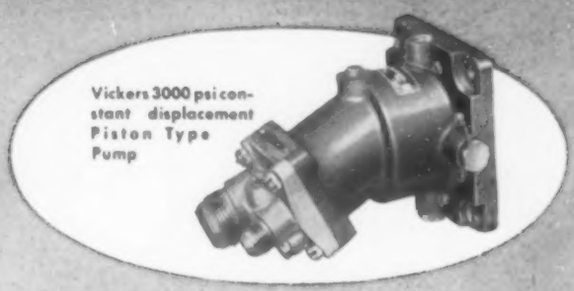
Write for Bulletin G

*** KINGSBURY FLEXIMATIC**

—a special purpose machine for combined automatic operations during a single chucking —the result of Kingsbury engineering ability in the use of low cost *standard* Kingsbury drilling and tapping heads on *standard* Kingsbury bases.

NATIONAL TOOL Co.
11200 MADISON AVE
NATIONAL Tools CLEVELAND
CLEVELAND, OHIO

VICKERS Hydraulic Pumps

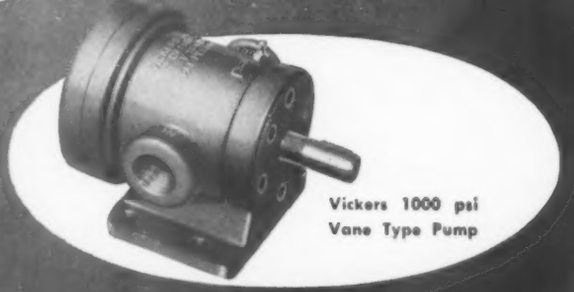


Vickers 3000 psi constant displacement Piston Type Pump

Reliability with minimum weight . . . greater safety and longer life . . . are among the exacting requirements of the airlines. It is significant to designers and users of many other types of equipment that Vickers Hydraulic Pumps and Controls are widely used in the 3000 psi hydraulic systems of these huge planes that are literally writing new pages in aviation history.

HIGH IN THE SKY

TO DEEP IN THE EARTH



Vickers 1000 psi Vane Type Pump

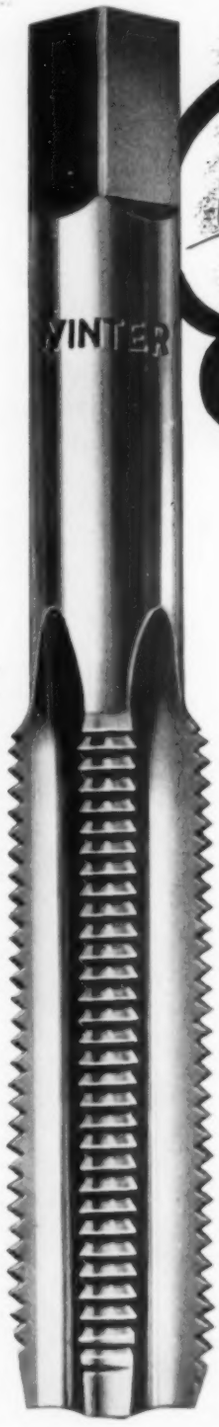
Huge cutting machines depend upon Vickers Hydraulic Pumps and Controls to speed the work and reduce the cost of mining coal. The operator controls the massive machine more easily than you drive your car.

Between these extremes, Vickers Hydraulic Equipment is serving industry in countless ways . . . wherever accurate, dependable and easy control is needed. In addition to the thousands of more widely known applications on metal working machinery, Vickers Hydraulic Pumps and Controls are used on construction equipment, motor buses, printing presses, agricultural machinery, marine equipment, oil well pumping units, textile and paper machinery, trucks, etc. Vickers Application Engineers will be glad to discuss with you how hydraulics can be used to your advantage.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

VICKERS Incorporated

Application Engineering Offices: ATLANTA ★ CHICAGO ★ CINCINNATI ★ CLEVELAND ★ DETROIT ★ LOS ANGELES
NEWARK ★ PHILADELPHIA ★ ROCHESTER ★ ROCKFORD ★ SEATTLE ★ TULSA ★ WORCESTER



Engineered

TO MEET TODAY'S EXACTING PRODUCTION REQUIREMENTS

Winter ENGINEERED Taps are designed
for new threading accuracy
faster cutting action
large output and longer tap life
Winter's modern manufacturing methods
close factory supervision and inspection
produce taps for high production
at exacting standards and
at lowest cost
Try Winter Taps on your next
really tough tapping assignment
Your local distributor stocks them
A Winter factory-trained field engineer
is always glad to work with you on any new
production problem

Winter Brothers

COMPANY Wrentham, Massachusetts, U.S.A.

BRANCH STORES SAN FRANCISCO, CALIFORNIA · CHICAGO, ILLINOIS · DETROIT, MICHIGAN

A DIVISION OF THE NATIONAL TWIST DRILL & TOOL CO., ROCHESTER, MICHIGAN

THE BOOK OF THE MONTH
—for users of High Speed Tool Steels

Now Ready!

With the recent introduction of Latrobe's DESEGATIZED High Speed Steels, Latrobe has set new standards of quality for the tool steel industry. This new booklet, just off the press, is chock-full of facts about Latrobe's new and further improved Desegatizing process, with illustrations and comparative microphotographs of rounds and other shapes . . . informative data that every user of High Speed steels should have!

Write for your copy—today.

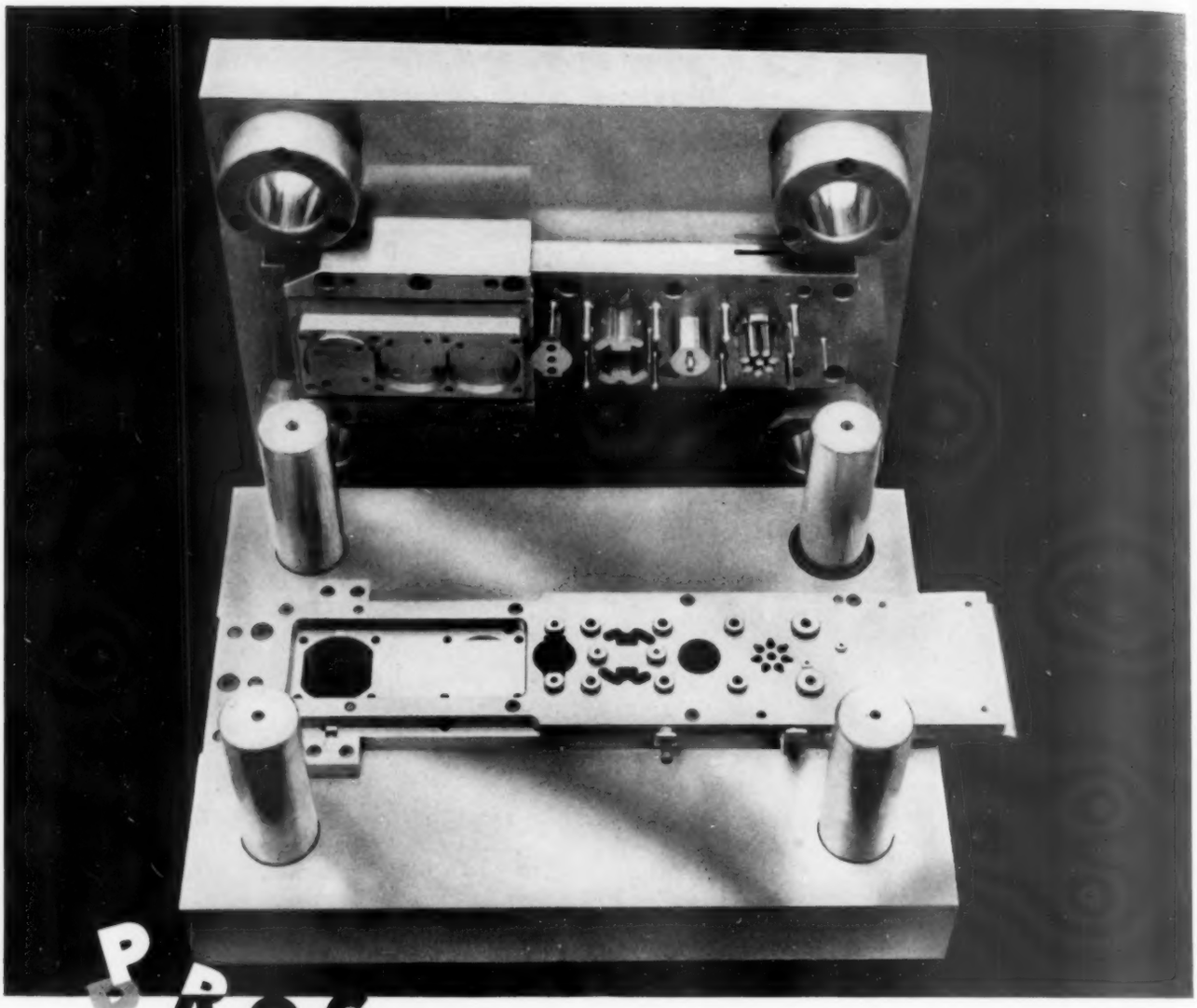
LATROBE

DESEGATIZED
HIGH SPEED STEELS

5

LESCO

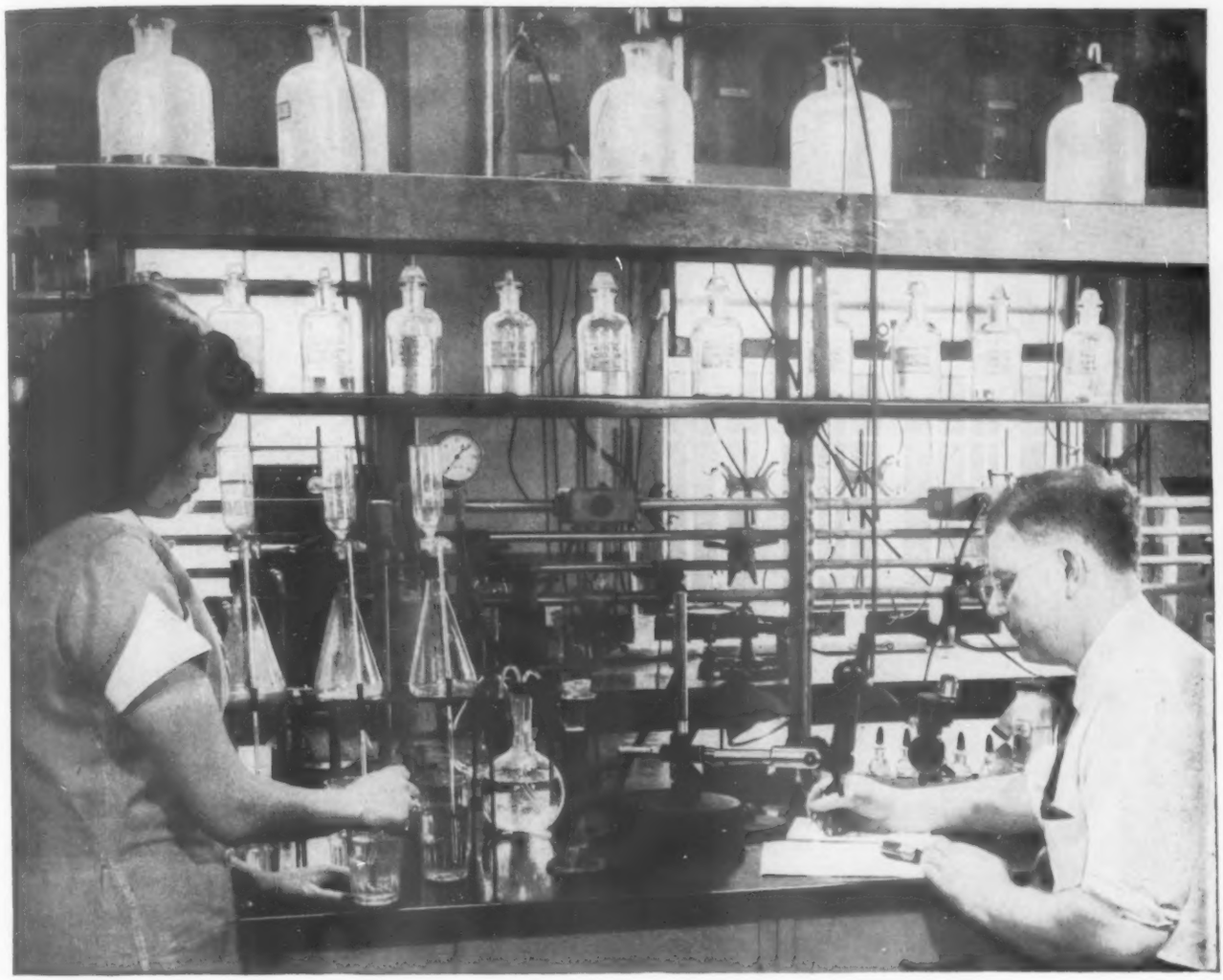
LATROBE ELECTRIC STEEL COMPANY • LATROBE, PENNSYLVANIA



PROGRESSIVE LAMINATION DIE

makes progressively one rotor lamination and one stator lamination for small motors. All details of this die are completely ground to extremely close tolerances both internally and externally. Another example of Olofsson precision.

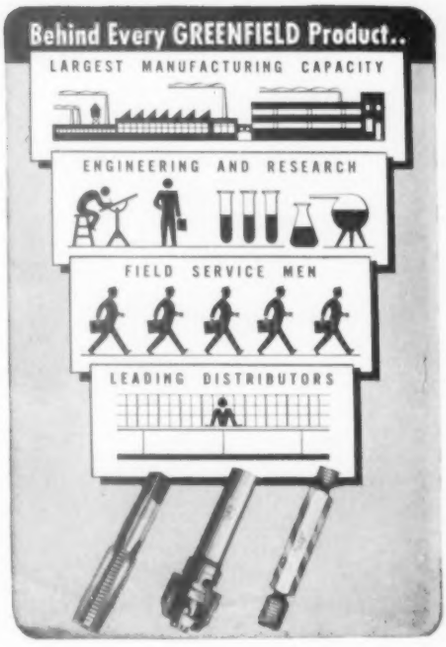
OLOFSSON TOOL AND DIE COMPANY
LANSING, MICHIGAN
CHICAGO ENGINEERING OFFICE • BUILDERS BLDG.
228 N. LaSALLE STREET CHICAGO, ILLINOIS



Feeling a tap's pulse

Visitors to the "Greenfield" plants are amazed at the laboratory techniques that are now a part of modern threading tool and gage manufacture. Surrounded by every device for the measuring and testing of precision tools, "Greenfield" metallurgical scientists and technicians keep tabs on "Greenfield" products every step of the way from the raw stock to the finished product.

In these metallurgical "clinics," they check the chemical composition, the microstructure, the hardness, the toughness, and the wear resistance. Because of such vigilance, users of "Greenfield" tools get ***more for their money*** in threading tool performance.



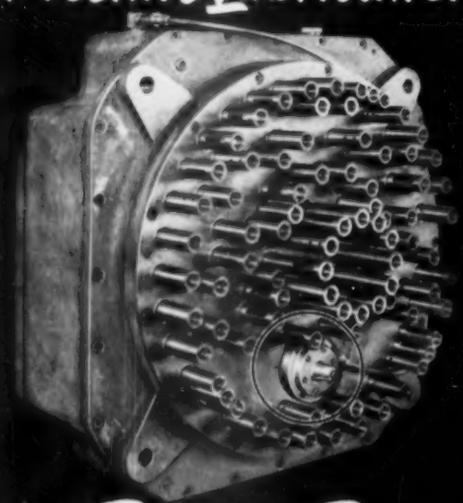
GTD GEOMETRIC

GREENFIELD

GREENFIELD TAP and DIE CORPORATION

GREENFIELD, MASSACHUSETTS

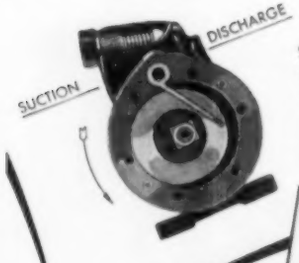
For Positive Lubrication



use Rollway Pumps

● For your lubrication jobs, you'll do well to consider slow speed, positive displacement Rollway Pumps. They're rotary pumps which assure you of *full capacity* all the time. They may be set considerably above the liquid *without danger of loss of prime.* They are available in standard models with capacities of 1 pint to 60 gallons per minute, as reversing or non-reversing, and with or without built-in relief valves.

NEVER WEARS OUT

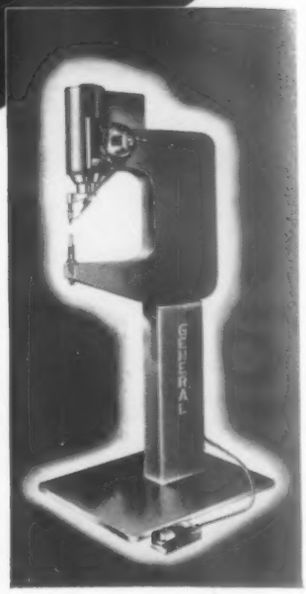


Simplicity itself! The roller does not revolve. Rather, it floats and is not subject to rotary friction which causes wear. Slip spring keeps pump tight, retains its vacuum.

PIONEER Pumps
SEAL TYPE, SEAL-LESS AND ROLLWAY
FOR PUMPING COOLANTS · CUTTING FLUIDS · ABRASIVE LIQUIDS · LUBRICANTS · WATER

Pioneer Pump & Manufacturing Co.
19645 JOHN R ST. • DETROIT 3, MICHIGAN

RIVETERS
Built for YOUR Job at "STOCK-LINE" prices



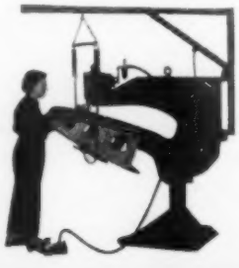
General Riveters will furnish a machine tailored to exactly fit your needs at a stock item price

THERE'S no need to pay a premium price for a special machine. If you have a riveting problem, we have the answer in a riveter especially designed for your job. Best of all, it will probably cost no more than a stock riveter.

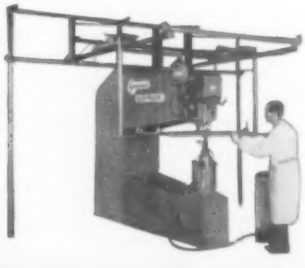
Under present conditions, many industries find it aids production, where the work permits, to use General Automatic feed riveters, equipped with indexing fixtures. They insure maximum output by setting the pace for the operators, and improve quality by reducing the human element.

Let us survey your riveting operations and recommend the best equipment for the job. There is no obligation. Simply send blue-prints or samples of parts to be riveted with a description of your present assembly procedure and production requirements. General Riveters Equipment is guaranteed, deliveries are prompt.

Pneumatic Squeezer for leading edges.



Combination Drill and Automatic Feed Hydraulic Squeezer.



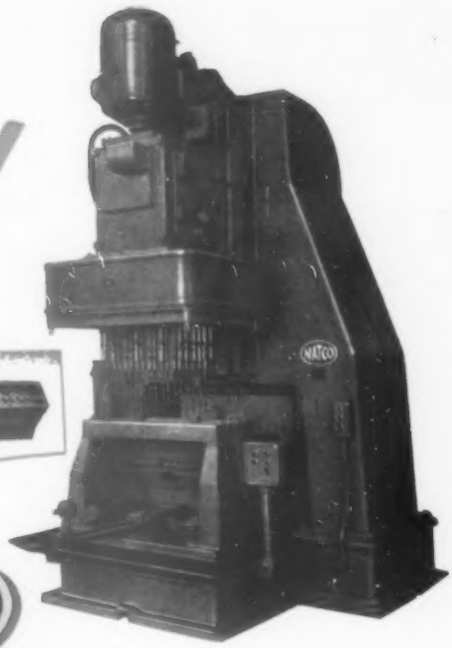
GENERAL RIVETERS INC.
formerly GENERAL ENGINEERING CO.
781 HERTEL AVE. BUFFALO 7, N.Y.

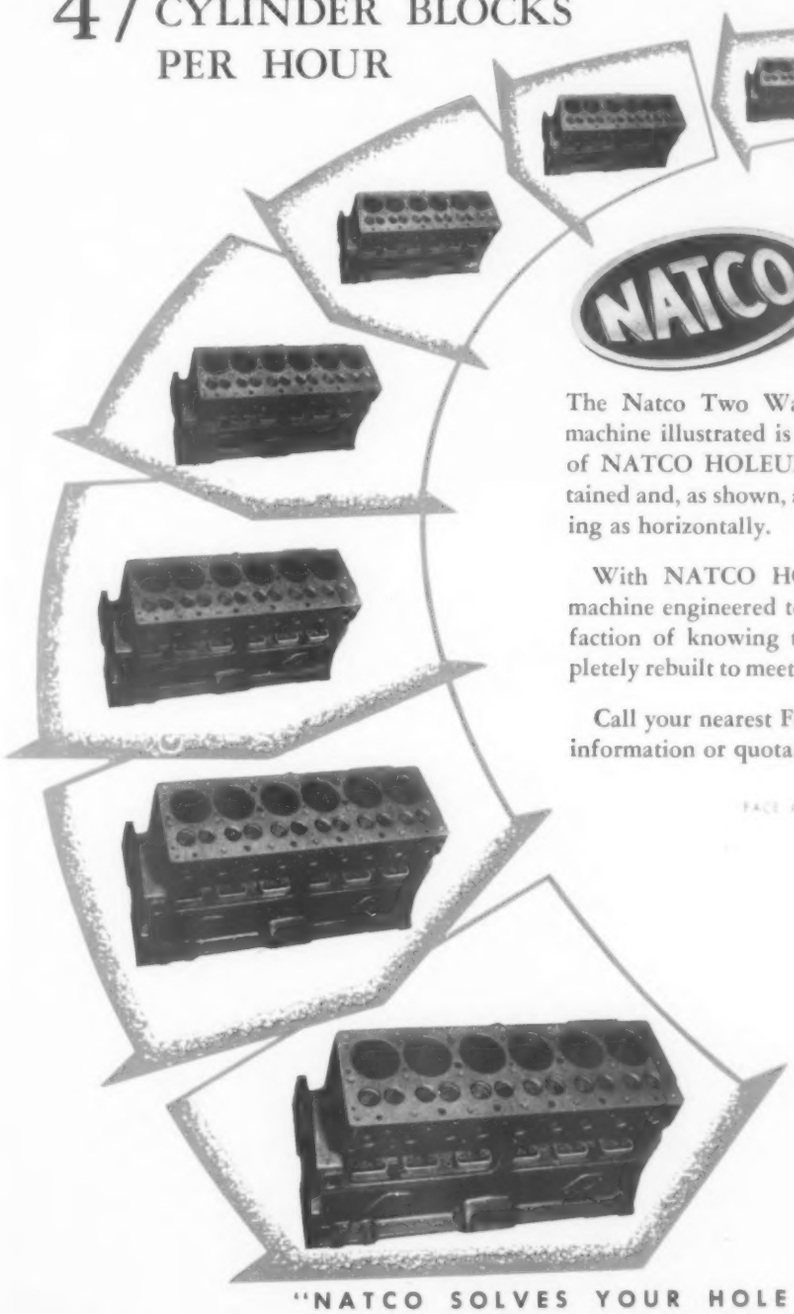
NATCO RIGHT ANGLE DRILLER

Composed of Two NATCO Holeunits, Two Spindle Boxes, Column, Base and Fixture

Producing!

47 CYLINDER BLOCKS PER HOUR





The Natco Two Way combination vertical and horizontal machine illustrated is an excellent example of the adaptability of NATCO HOLEUNITS. These units are entirely self-contained and, as shown, are equally as efficient in a vertical mounting as horizontally.

With NATCO HOLEUNITS you can have a way type machine engineered to your exact specifications, with the satisfaction of knowing the entire set-up can be altered or completely rebuilt to meet any design changes, should the need arise.

Call your nearest Field Engineer or Sales Office for complete information or quotations.

The operations performed on the above machine are as follows:

Vertical Unit — Face A
- Drill 16 valve tappet holes.
- Drill 13 water holes.
- Drill 3 miscellaneous holes.

Horizontal Unit — Face B
- Drill 17 manifold stud holes.
- Drill 1 miscellaneous hole.

"NATCO SOLVES YOUR HOLE PROBLEM"

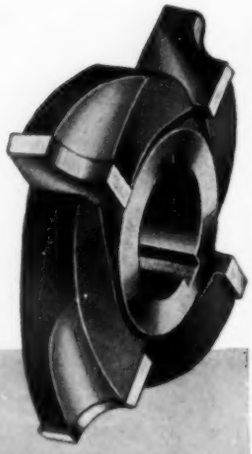
National Automatic Tool Company, Inc., Richmond, Ind.

MULTIPLE DRILLING, BORING, AND TAPPING MACHINES

INVESTIGATE NATCO METHODS FOR THE LOWEST POSSIBLE HOLE COSTS!

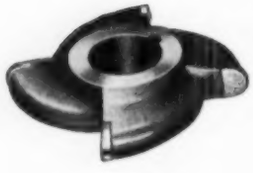
SALES OFFICES: 1809 ENGINEERING BUILDING, CHICAGO; 409 NEW CENTER BUILDING, DETROIT; 1507 ELMWOOD AVENUE, BUFFALO; 2903 COMMERCE BUILDING, NEW YORK CITY

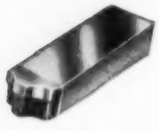
For FASTER SMOOTHER CUTTING, LONGER LIFE and BETTER FINISH—

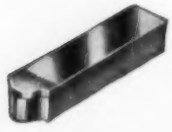


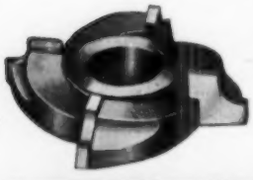
Meyers

Carbide Tipped FORM TOOLS









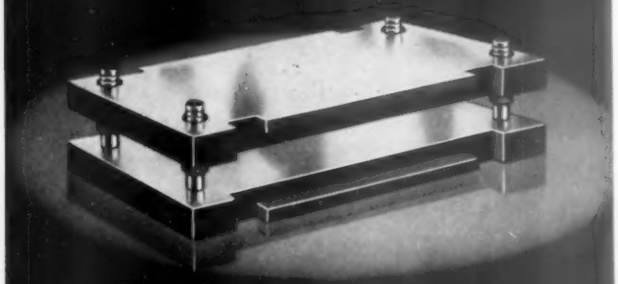
The Meyers method of generating carbide-tipped tools insures the accuracy of each radius. On milling cutters all teeth are precisely uniform, thereby distributing the work evenly over the entire cutter. This accuracy ar uniformity increases the life of the tool amazingly, and insures a much better finish on the work.

We are equipped to grind tools to your specifications, and to engineer special tools for your particular job. Write for complete information, or send us your prints for a quotation.

W. F. MEYERS CO., INC.
ESTABLISHED 1888

1024 14th Street *Bedford, Indiana*

Finely Made Special Die Sets



We are well qualified by experience and well equipped mechanically to produce special die sets of the highest quality. Send us your prints or call the "Detroit" man in your area. We also supply standard die sets in all sizes, and all kinds of accessories.

CALL "DETROIT"

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MINNEAPOLIS	AT 5264
DAYTON	HE 3042
TOLEDO	GA 5706
SEATTLE	SE 2090
PORTLAND, ORE.	AT 1466
SAN FRANCISCO	MA 8532
BUFFALO	PA 9206
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DETROIT DIE SET CORPORATION
2895 W. GRAND BLVD. • DETROIT 2, MICH.

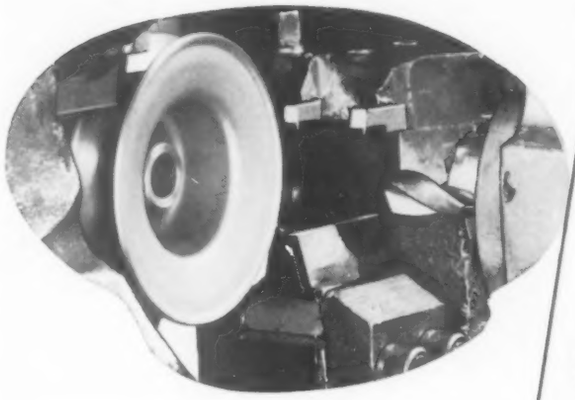
DETROIT DIE SETS ★

JOB LOT WORK or MASS PRODUCTION

CARBOLOY
CEMENTED CARBIDES

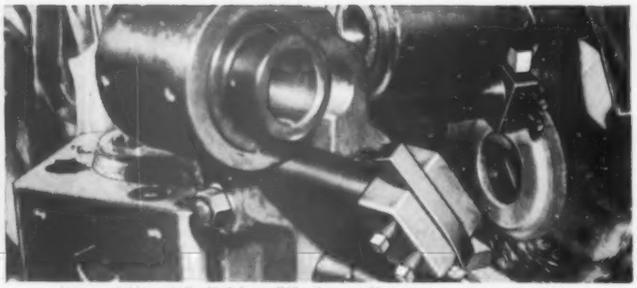
"Standards"

Speed Output—Cut Costs!

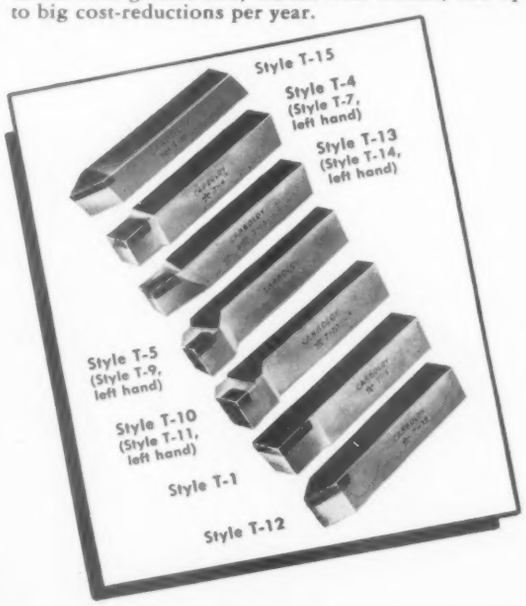


Machines Run 4 Times Longer Per-Tool-Grind! In job-lot machining of cast iron pulleys, "Standards"—adapted to 8 roughing and finishing operations—held down initial tool costs, stepped up production, kept machines running 4 times longer per tool grind.

4 Stations on Turret Eliminated—19 Tools Saved! By tooling up with Carboloy Cemented Carbide "Standards", 4 turret stations were eliminated, 19 tools saved. Savings like this, month after month, add up to big cost-reductions per year.



80% of Hand-Polishing Eliminated! High surface finish obtained in mass-production machining of this steel gear made possible cutting hand-polishing time 80%.


Style T-15
Style T-4 (Style T-7, left hand)
Style T-13 (Style T-14, left hand)
Style T-5 (Style T-9, left hand)
Style T-10 (Style T-11, left hand)
Style T-1
Style T-12

CHANGE TO CARBOLOY "STANDARDS" FOR RESULTS LIKE THESE IN YOUR PLANT

A change to Carboloy Cemented Carbide "Standards" is a change to increased production, better finish, lower cost. Available in 11 Standard Styles—adaptable to 60%-80% of the turning, facing and boring jobs, they are actually priced lower than ordinary tools in many sizes.

For a useful guide to most efficient use of "Standards", grades, prices, specifications, etc., write today for Catalog GT-175R.

The word "Carboloy" is a registered trademark of Carboloy Company, Inc., sole makers of Carboloy Cemented Carbides.

CARBOLOY COMPANY, INC.
11124 E. 8 Mile Avenue • Detroit 32, Michigan

Standard CARBOLOY TOOLS
(TRADEMARK) CEMENTED CARBIDE

STOCKED BY AUTHORIZED CARBOLOY CEMENTED CARBIDE DISTRIBUTORS
IN 69 CITIES Coast To Coast

CHICAGO • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES • MILWAUKEE • NEWARK • PHILADELPHIA • PITTSBURGH • THOMASTON

SURPLUS unused *tubing*

FOR IMMEDIATE SALE

Standard and Non-Standard O. D.'s and Wall Thicknesses
Range of Sizes from ¼" to 7"

Types: Carbon, Alloy, and Some Stainless; Both Welded and Seamless.

Price: ALL TO BE SOLD ON FIXED PRICE BASIS, F.O.B. LOCATION.

Delivery: Subject to Arrangement at Time of Sale Between Buyer and Regional Office Having the Stock.

Where to buy: Write, Wire or Phone Your Nearest War Assets Regional Office Below, indicating the type, size and specifications in which you are interested.

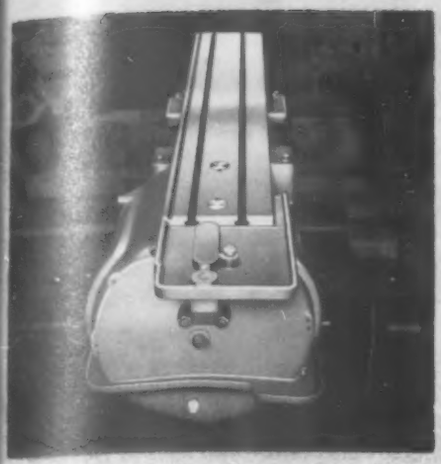
Orders received by 5 P. M. November 4, 1946 will be filled in the following sequence. As provided by law; (1) Certified veterans of World War II; (2) Subsequent priority claimants in proper sequence; (3) Non-priority Purchasers. Veterans of World War II should apply to their nearest War Assets Administration certifying office for certification; the case number shown on certification and the location of the certifiing office must be stated in a veteran's offer to purchase.

WAR ASSETS ADMINISTRATION

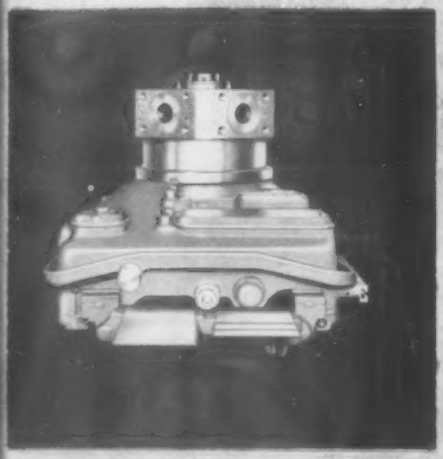
GOVERNMENT OWNED SURPLUS

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia • Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane

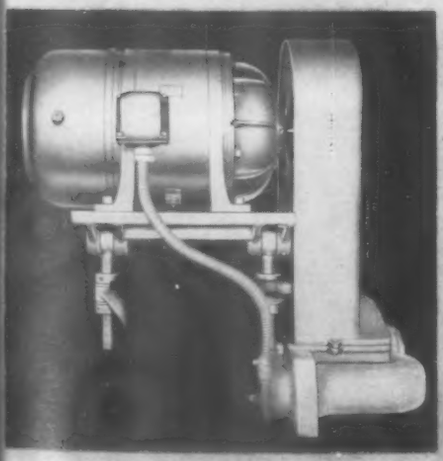
157-7



Cross Slide Unit and base are of modern design. The cross slide cam drum is located under the cross slide and the ball bearing cam roll studs are mounted in the cross slide, thus furnishing a direct connection. The cam drum is carried in a compartment at the rear, outside baseways and is readily accessible for application of special cams.



Turret Slide and Unit are of liberal proportions. Turret Slide is provided with hardened and ground steel inserts to form its bearings on base ways, which are also of hardened and ground steel. Turret is automatically clamped in position after indexing. Five turret faces are provided for mounting of tools.

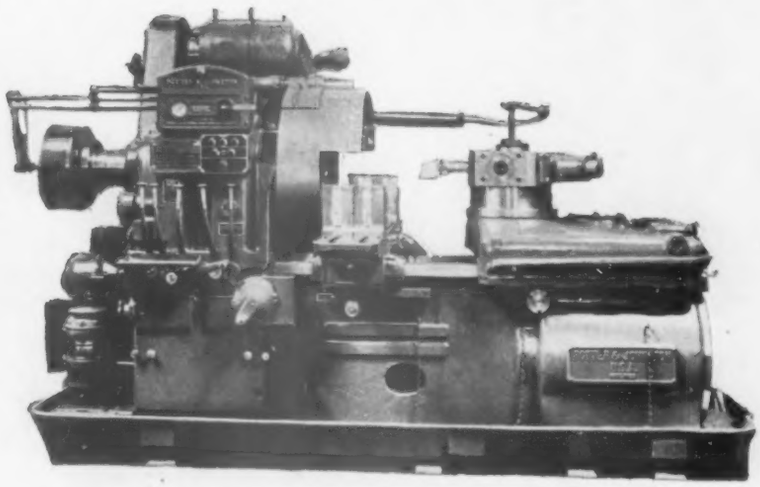


Motor Drive is provided through a special multiple V-belt. A constant speed motor is mounted at rear of headstock and is equipped with a constant speed driving pulley. Another constant speed motor for driving fast motion mechanism is provided and is reversible for setting-up purposes.

P&J

6-D REL & RELX

AUTOMATICS



. . . *with time-proved features that cut production costs*

These P&J Automatic Chucking and Turning Machines . . . the product of more than forty years specialized experience . . . can be depended on to put the production of large duplicate parts in quantity on a low cost, profitable basis. The features described here are typical of P&J leadership in the design and construction of automatic chucking equipment.

Ask for Bulletin 118 giving further details on the 6DREL P&J Automatics. Call on P&J engineers for advice and assistance on your problem of duplicate parts production.

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Make an Extra Effort and Buy those Extra Victory Bonds Now!

Glenco KEEPS HOLES TRUE

Let This Floating Holder

Automatically Compensate for Misalignment!

It eliminates large and bellmouthed holes when your machines are worn and spindles are out of alignment with work.

It reduces the causes of misalignment on new machines.

Increases Production by Reducing Rejects

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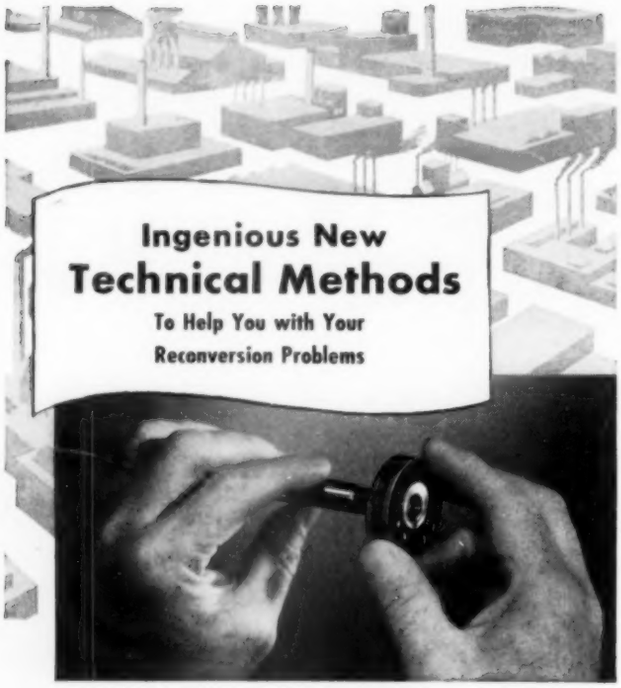
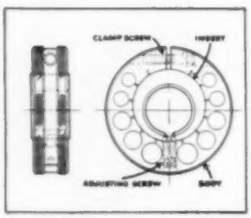
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS



New Thread Ring Gage Starts Round Stays Round With Every Adjustment!

Employing a new principle of design, the Woodworth Thread Ring Gage closes in round within .0002 maximum after .005 adjustment. It offers greater accuracy and stability since size adjustment is controlled along thread helix angle. Threads are held securely in alignment after adjustment, due to unique adjustment means. Wear is distributed over full circumference for all resettings, thus increasing life of gage.



Woodworth Thread Ring Gage

Positive adjustment makes it almost impossible to change setting with ordinary knocks. Positive identification by a green "go" gage and red "not go" gage saves operator time. Aluminum alloy outer body cuts weight in half, to reduce operator fatigue and increase sensitivity.

To also reduce fatigue on precision jobs, many plant owners make chewing gum available for workers. Tests show that the act of chewing aids in relieving tension, which is often the cause of fatigue. These tests further reveal that chewing Wrigley's Spearmint Gum, for instance, helps workers stay alert, thus increases their efficiency to do more accurate work.

You can get complete information from
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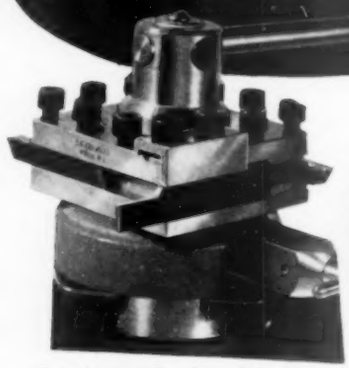
Detroit 20, Michigan

AA-94

A Proven Production Tool



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On thousands of applications, during the past ten years, these turrets have proven a real production tool. On all kinds of jobs . . . necking . . . cutting-off . . . turning . . . threading, etc., it has saved time and cut costs, on as few as fifty pieces or as many as fifty thousand. Easy to mount . . . positive locking device assures accurate indexing . . . holds four tool bits . . . built-in cutting-off tool . . . inexpensive. Write for folder and prices. Immediate deliveries.

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This hand-operated, pedestal model Universal Marking Machine can be tooled quickly and easily for a wide variety of marking jobs.

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The same assembly may be used for marking either flat or cylindrical surfaces—merely changing the type holder and cradle.

Watch how this easy-to-operate machine marks parts at a fast clip. Regulating screws and other simple adjustments make setting up unusually easy.

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Top honors in the field of farm machinery production go to the punch press because the press is the fastest means of accurately duplicating metal parts.

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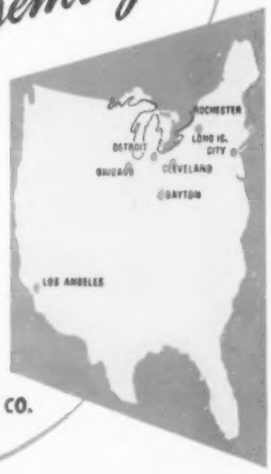

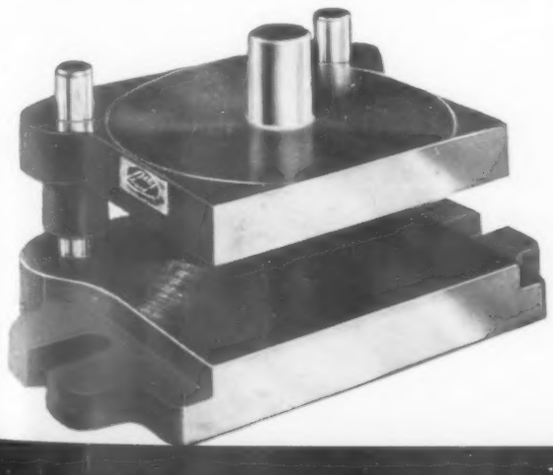

DIE MAKERS' SUPPLIES

DANLY DIE SETS

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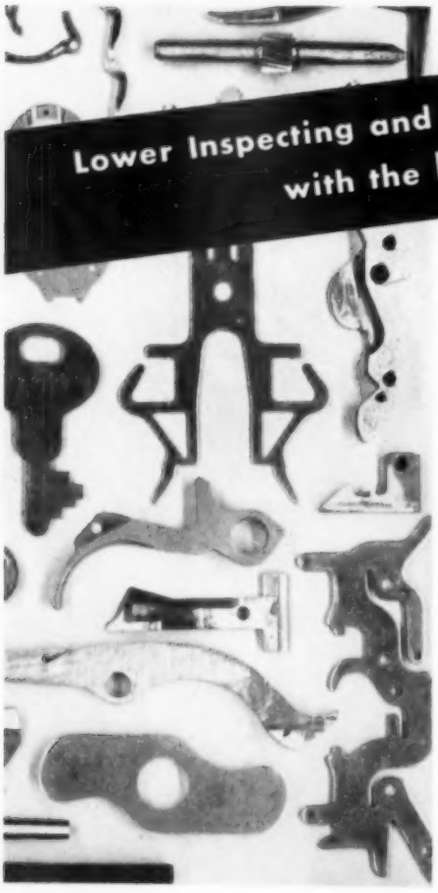

Lower Inspecting and Measuring Costs on Parts Like These with the Bausch & Lomb CONTOUR MEASURING PROJECTOR

HOW do you measure, compare, and inspect machined parts? Have you checked your methods with advantages of the Bausch & Lomb Contour Measuring Projector?

This versatile, precise, optical instrument provides a modern method that is simple, economical, and fast. It projects a sharp, distinct, geometrically true, magnified silhouette of the object. Dimensions, angles, and profiles may be compared directly with a large scale drawing superimposed on a plain screen. By utilizing a protractor screen, all angular measurements can be made to ±1 minute of arc (1′)—an accuracy not available with any other projector. Also, direct measurements, accurate to ± .0001″, may be made by means of the cross slide stage with its attachments.

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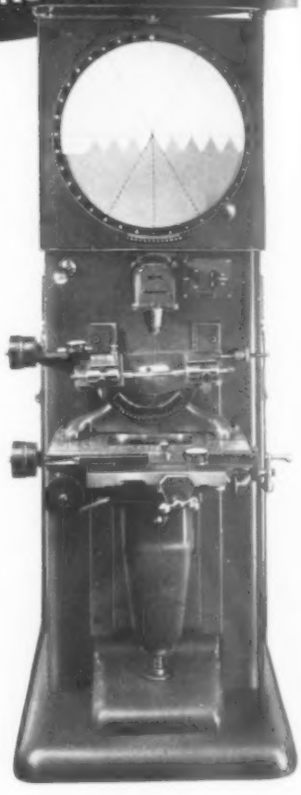

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Insert in bar.
Complete cutter bar and insert showing cutting edge.
The micrometer dial of the insert has 25 graduations, each being one-thousandths of an inch.

Quick, enthusiastic acceptance was received for this new time and money-saving boring-bar insert. It has many advantages found in no other insert.

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It is unnecessary for you to come to us for cutter replacements. Cutters can be made in your own shop from scrap bits of hi-speed steel. No special tools necessary. Only a simple grinding operation required.

The insert can be installed in any bar available by a simple boring and milling operation. The locating head of the boring-bar insert fits snugly into the recessed slot of the bar. The set screw in the boring bar locates the insert and draws the head firmly against the shoulder of the recessed slot in the bar. Accurate location point is always maintained. *The Nash-Zempel boring-bar insert is available in forty standard sizes, with special sizes on request.*

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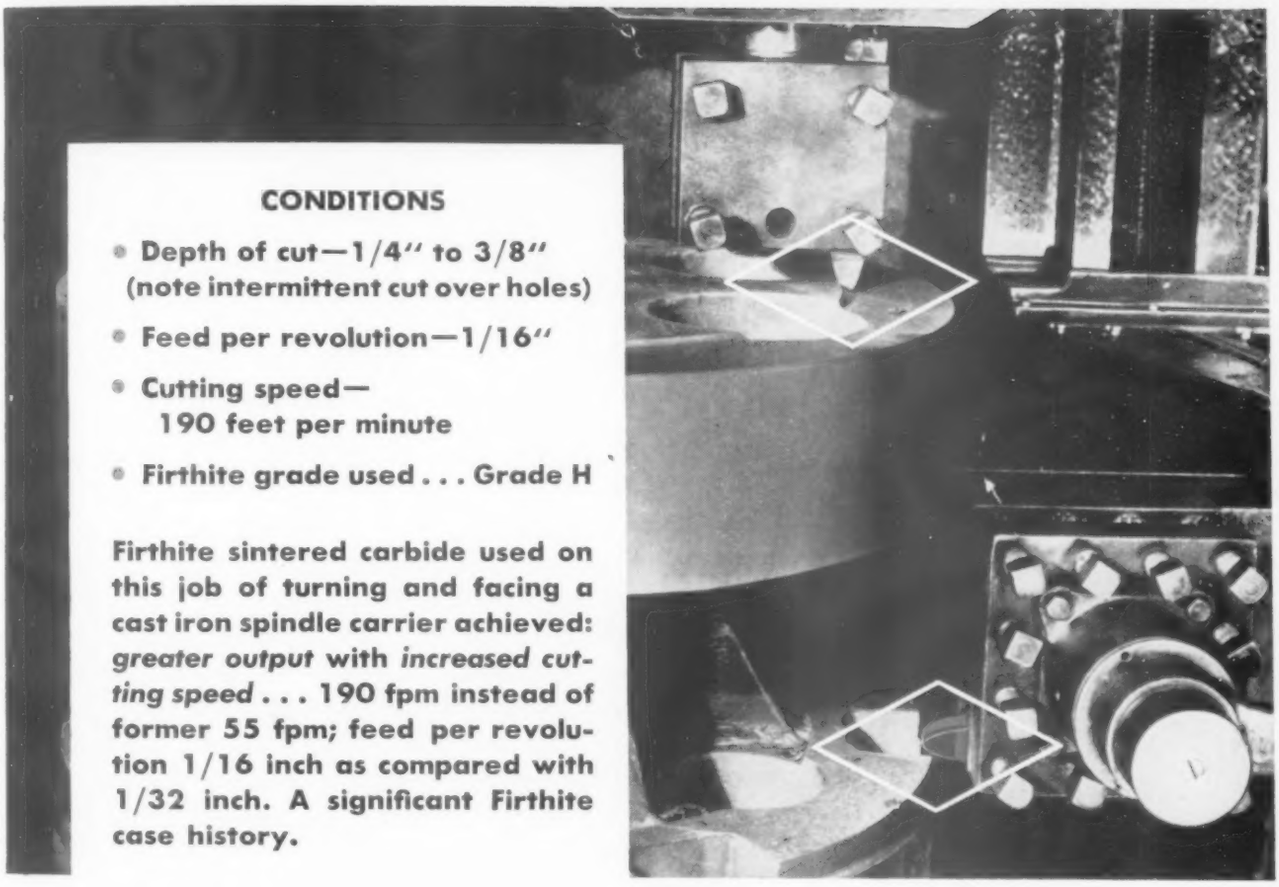
5 times as many pieces per grind at double the feed and triple the speed with FIRTHITE



CONDITIONS

- Depth of cut—1/4" to 3/8" (note intermittent cut over holes)
- Feed per revolution—1/16"
- Cutting speed—190 feet per minute
- Firthite grade used . . . Grade H

Firthite sintered carbide used on this job of turning and facing a cast iron spindle carrier achieved: *greater output* with *increased cutting speed* . . . 190 fpm instead of former 55 fpm; feed per revolution 1/16 inch as compared with 1/32 inch. A significant Firthite case history.

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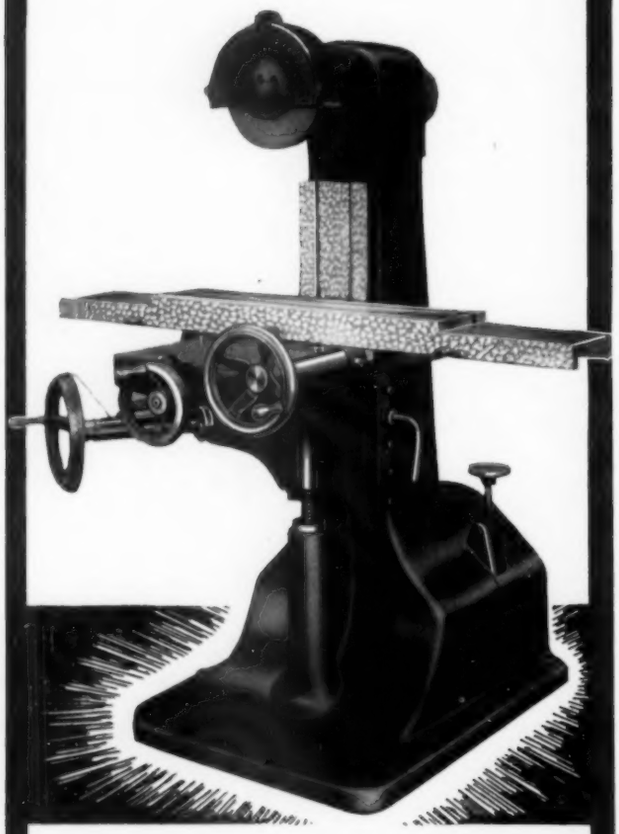
NO. 11 LEACH SURFACE GRINDER



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2600 and 3500 R. P. M.

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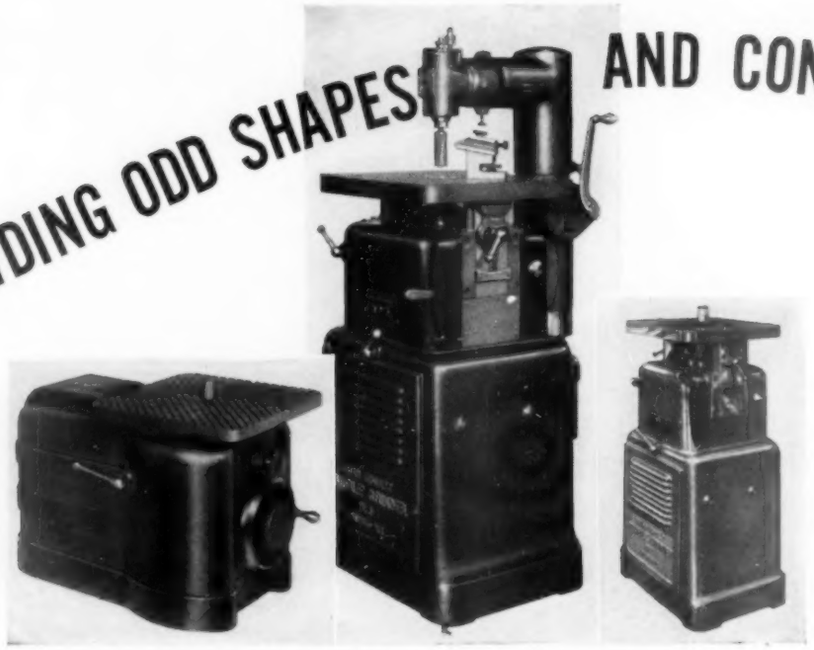

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With lower spindle only. A tool that has demonstrated its value in the tool and die shop.

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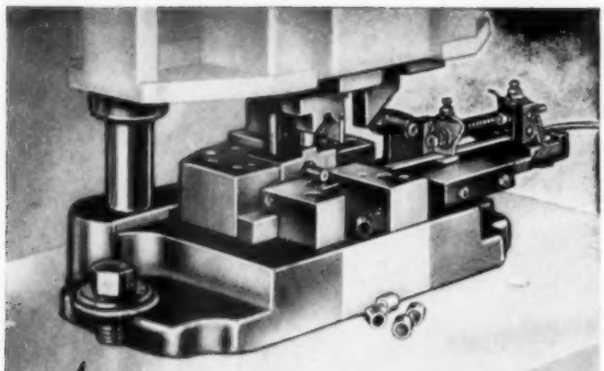

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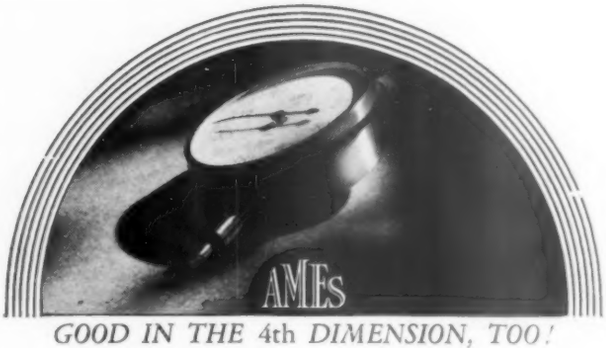

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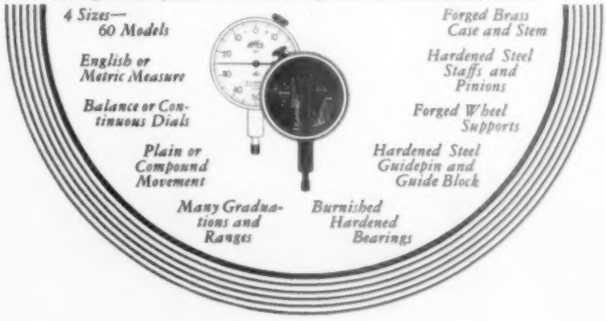
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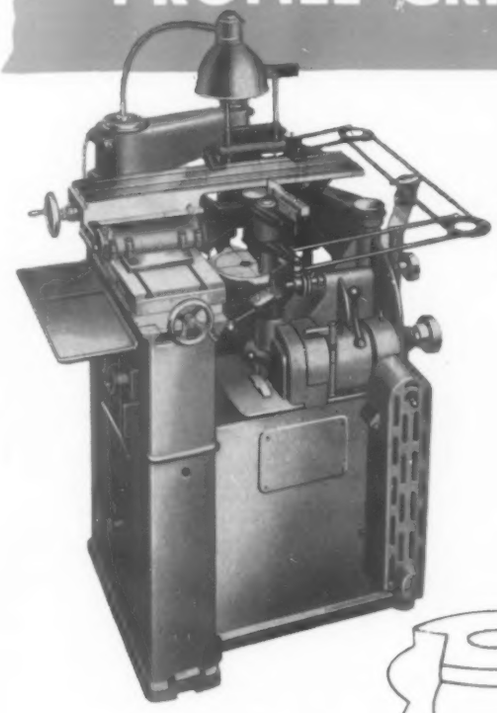
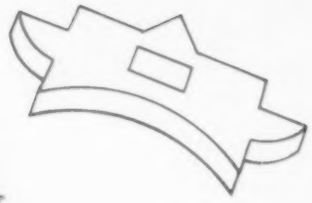
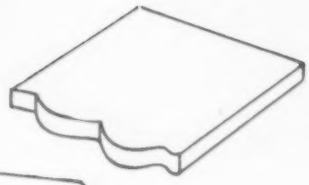
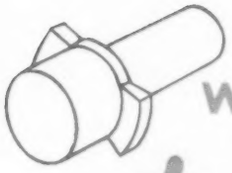


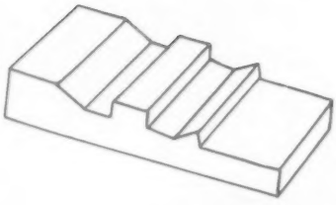






WITHIN LIMITS OF

± 0.0002"



Now you can perform intricate profile grinding at practical high speeds and to exceptional degrees of accuracy! With the Studer Profile Grinding Machine Type PSM you can attain accuracy to within ± 0.0002" in producing profile gages, straight or circular form tools, sectional dies, complete contours like cams, templates and similar parts of hardened steel. Profiles up to 5.9" in length can be ground from end to end in one continuous operation without moving work-piece or template. Circular work up to 4" in diameter can be ground, and flat pieces—several of which can be stacked for grinding at one time—can be handled up to 2" in thickness. Small sized profiles can be accurately produced without preliminary grinding to form, and clearance angles on parts such as form tools can be ground without removing the work from its original setting.

These are the highlight features of the Studer Profile Grinder. If you can use its exceptional accuracy, its speed and ease of operation, its amazing versatility, write for complete information.

We also represent in the United States these other makers of Swiss High Precision Equipment: Societe Genevoise d'Instruments de Physique (SIP), Andre Bechler, Maag Gear Wheel Co., Mikron, Safag, Sallaz, Schaublein, Lienhard, Billeter. Our engineers will be glad to work with you in specifying and using equipment for the highest precision machining.

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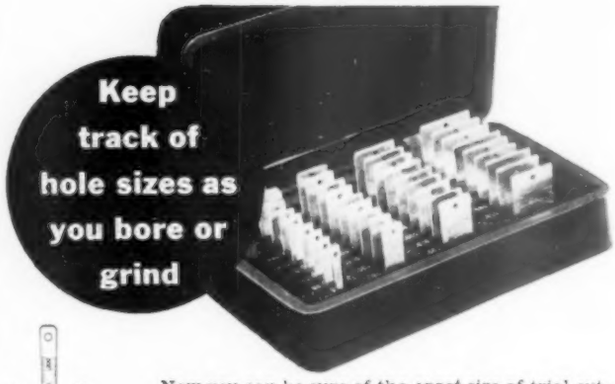

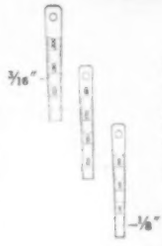

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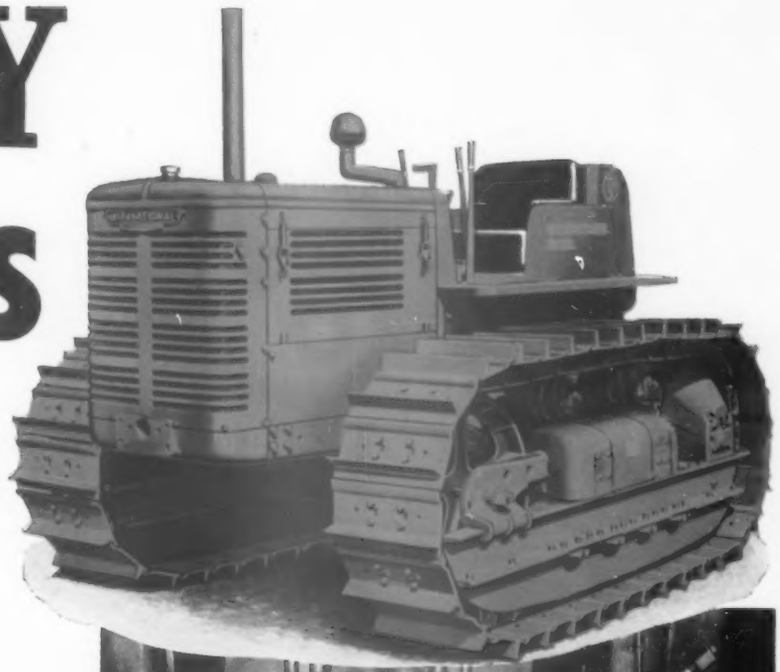
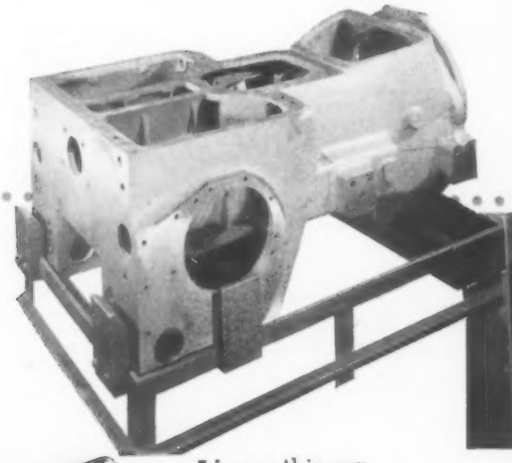
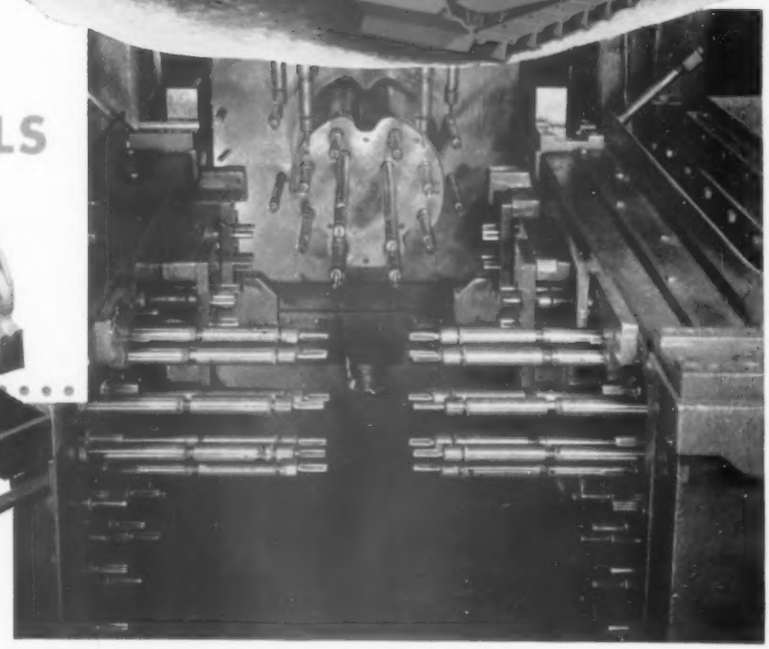


Share in the Production of INTERNATIONALS



Above: this rugged, one-piece frame casting is the "back-bone" of an International Tractor



For multiple tapping on tractor frames, this automatic machine, equipped with Besly high-speed taps, threads 89 holes in a single operation.

Profitable Facts For Tap Users

This handy booklet offers useful information on taps and tapping procedures It's written by shop men for shop men. Tap fits and drill sizes are listed in detail. Write today on your own letterhead for your copy—free.

The International Harvester Company relies on Besly Taps for many threading operations in building its world-famous diesel tractors.

For more than 50 years—Besly Taps have proved their outstanding capacity for clean-cut, low-cost work. A list of Besly Tap users is a directory of well-known American manufacturers.

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This cast-steel mixer blade was hard-faced with HAYNES STELLITE No. 6 welding rod. Protected areas include the leading edge of the 26-in. blade and the stuffing box bearing, 6 in. in diameter.

These hard-faced cast-steel blades—used to mix an unusually abrasive rubber compound—are still out-to-size and in good operating condition after more than 5 years of service.

Before they were protected by a welded-on coating of abrasion-resistant HAYNES STELLITE alloy, the abrasive action of the compound caused the edges and the bearing surfaces of the blades to wear away after a relatively short time. The service life of the unit was approximately 8 months. Hard-facing the blades eliminated the down-time previously required for frequent replacement and, by maintaining operating efficiency at a high level for a long period of time, has brought substantial savings.

It pays to use hard-facing with HAYNES alloys to protect new parts before they are worn, also to reclaim worn parts and protect them against further wear. Write for your copy of "Hard-Facing Materials Data" . . . there is no charge.

A view of the two mixer blades as installed in the 100-gal. mixing tank. After 5 years these blades are still out-to-size and in good working conditions. Unfaced blades lasted about 8 months.

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TOOLS for PRECISION PRODUCTION

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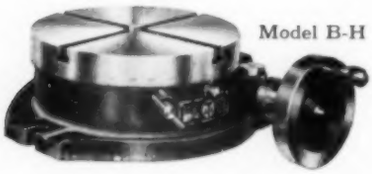

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A useful addition to any shop doing a variety of work. Often takes the place of a costly fixture.

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Rotary table may be used for work on milling machines, shapers, drill presses and horizontal boring mills.

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These Angle Plates are made of the best grade of gray iron, machined and ground true with the holes, all steel parts are hardened and ground.

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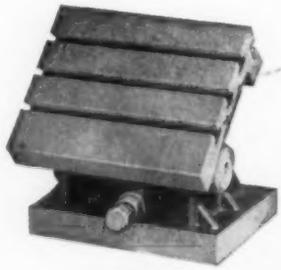

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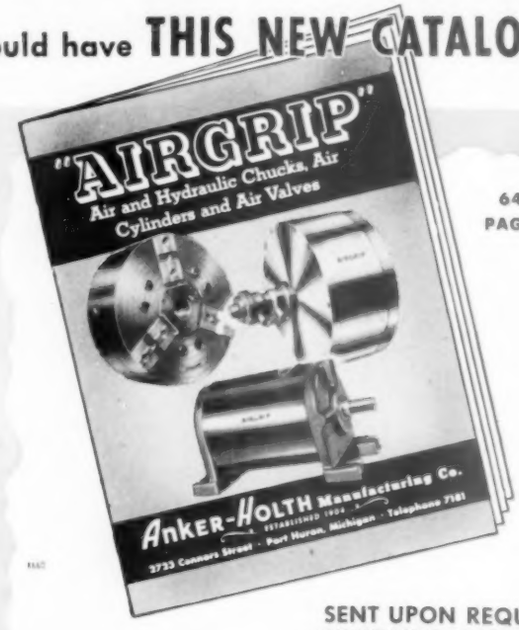
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This illustration shows just one of many applications of tracer control as applied to milling. Gorton tracer controlled equipment includes Duplicators, Pantographs and Electric Arc Etchers for milling, engraving, etching and many other metal removal operations.

Simplicity of operation, high spindle speeds and precision are built-in Gorton characteristics which enjoy enthusiastic approval among thousands of Gorton users throughout the world. It will pay you to investigate Gorton Tracer Control now.

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Send us complete description with prints of one of your jobs. Our Engineering Department will send you a production estimate on the same job tooled on Gorton tracer controlled equipment—no obligation.

JOB FACTS

NAME OF PART—*Packaging Machine Cover*

MATERIAL—*Cast Iron*

MACHINE—*Gorton 9-J Duplicator*

OPERATION—*Mill Gasket Groove—10 in lot*

ACTUAL CUTTING TIME—*4½ Minutes each*

CUTTING TOOLS—*Gorton End Mill—10 Pieces per Sharpening*

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REPUBLIC'S cleared major diameter of the ring gage permits the maximum number of resets and reworks at a minimum cost. REPUBLIC'S method guarantees that the relief will be centered in the thread root. Rings over ⅞" have a ground relief, which resists the adhering and wedging of dirt.

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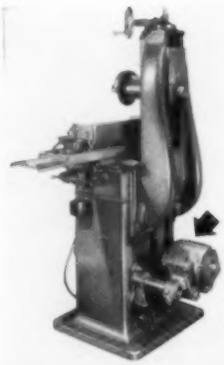

By eliminating complicated pulley arrangements and costly lineshaft maintenance, Masterdrives power surface grinders for maximum efficiency and economy.

Masterdrives for surface grinders are engineered as complete units ready to install. No machine work needed. Proper belt tension is maintained at all times.

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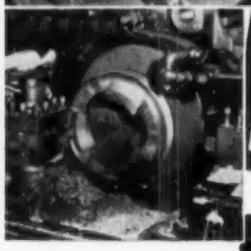
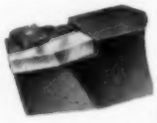
KENNAMETAL K6 Machines CAST IRON *with Maximum Economy*

Kennametal Grade K6 is one of the most useful and needed recent developments in tool materials for machining cast iron and non-ferrous metals. It is an improved tungsten carbide having unusual strength in combination with exceptional abrasion-resistance and high hardness. The four performance studies outlined below are typical of scores of comparative service results that clearly show the superior properties of K6 for interrupted and continuous cutting on cast iron.



MULTIPLIES OUTPUT, ON FACING OPERATION, ON SANDY IRON CASTING



Replacing another make of carbide with a Style 11HD Tool having a clamped-on, advanceable K6 tip, made possible tripling the feed, doubling the cutting speed, and facing 8 times as many pieces per regrind. Operation—facing sandy iron castings. Feed—.036". Depth of cut—1/8" to 3/16". SFM-150 at start, 320 after tool entered cut.

REMOVES TONS OF METAL FROM CHILLED CAST IRON PARTS, AT TOOL COST OF 74 CENTS PER TON

Style 12 Tool with K6 tip turns 1⅛ lineal miles between grinds! Other makes of carbide failed at all speeds and feeds. After 10 regrinds K6 tip is used on lighter jobs. Operation—turning cast iron piston trunks, 21½" diameter, having six 3" or 4" ports (interrupted cut). Chilled around port holes. Very sandy surface. Feed—.09375". Depth of cut—⅛". SFM-120.

CUTS 35 PIECES (on Abrasive Electric Iron) AS AGAINST 3 FOR CARBIDE PREVIOUSLY USED

This unique tool, tipped with Kennametal K6, turns out 11⅓ times as much work between grinds as the carbide tool previously used. Operation—finish trepanning cut on electric iron part. Feed—.003". SFM-210. Accurate tolerances and good finish required, and produced.

TURNS OUT 10 TIMES AS MANY PIECES, ON ROUGH CASTING, BETWEEN REGRINDS

One to four pieces between grinds was the best performance recorded by other carbides on machining a webbed flange of inferior grade cast iron, having hard spots, and sand pockets. K6 turns out more than 40! Operation—turning outside diameter and facing both sides of hub and rim. Feed—.032". Depth of cut 1/16" to 3/8". SFM-280.

The best way to prove that K6 makes possible better, faster machining on cast iron, at lower tool costs, is to try it in your own shop—then compare tool performance and overall costs. Order a few Kennametal blanks, or complete tools, now—and ask our district field engineer, who is fully acquainted with the properties of K6, to help you get maximum results from this *new* and *improved* tungsten carbide—Kennametal Grade K6.

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SUPERIOR CEMENTED CARBIDES
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(ON THE TIP OF THE TONGUE)

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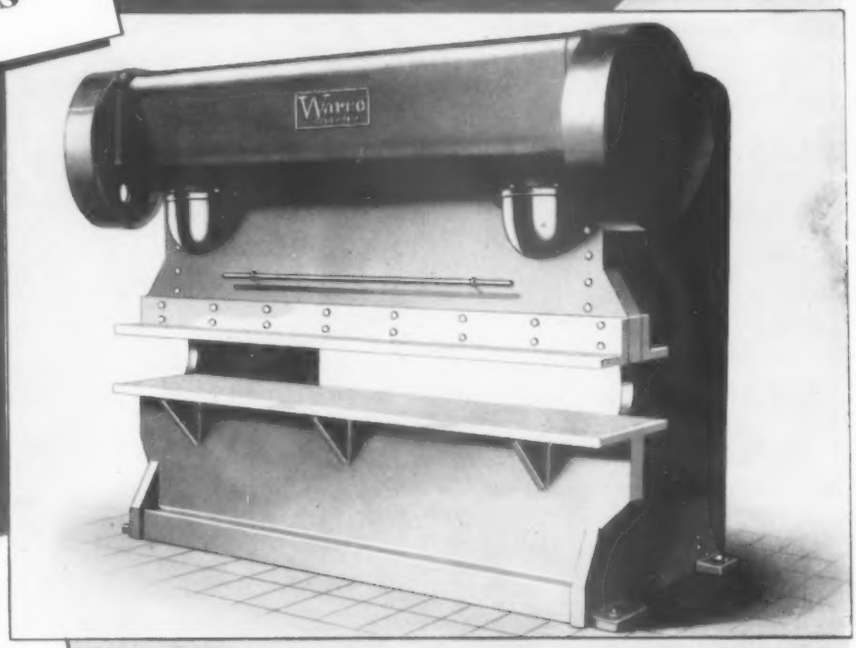

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Warco mechanical press brakes are built in capacity range from 100 to 1000 tons, to handle lengths up to 24 feet and longer. Low overall height, compactness and extra long gibways are features.

Warco Advantages:

THE MOST MODERN OF WELDED-STEEL PRESSES

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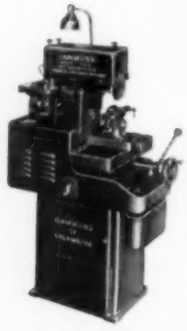
A MODEL FOR EVERY NEED

10" WET or DRY GRINDERS
Hammond makes a complete line of Wet or Dry Carbide Grinders for 6" to 14" wheels.



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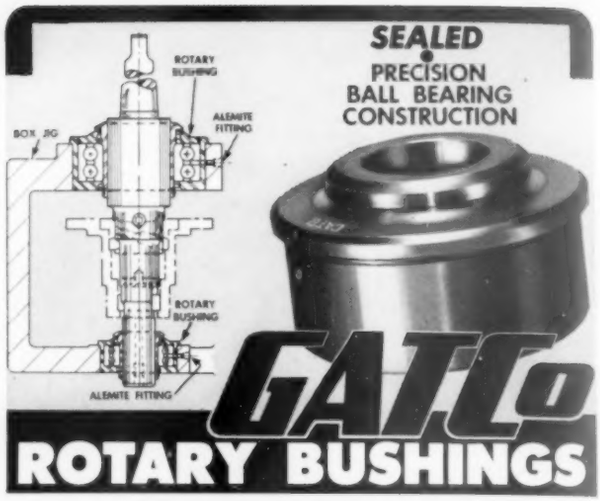

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FOR DRILLING, CORE DRILLING, ROUGH AND FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

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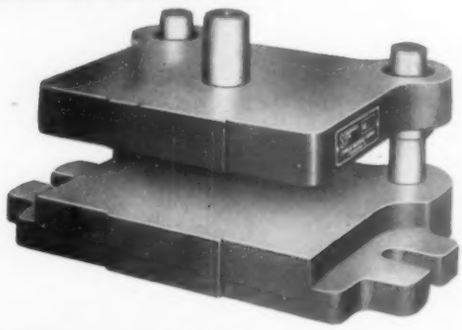
PRESSES AND ACCESSORIES

ALL-STEEL DIE SETS



Keep your dies set up in "Standard" All-Steel Die Sets ready for instant use. Made with the same high precision as "Standard" Power Presses. Fully interchangeable parts; complete range of sizes. Ask for new Steel Die Set catalog just off the press.

MODEL 3T POWER PRESS

"Standard" Model 3T is a popular, efficient power press for set-ups as large as 8" x 11½". Fitted with an improved roller type clutch; adjustable for single stroke or continuous operation. The clamp type punch holder speeds the handling of die sets. Model 3T is complete with geared head motor and has many features for safety and convenience, including two-hand safety trip and inclinable frame. "Standard" Roll Feed and Dial Feed Accessories available. Write for new Bulletin 3T.

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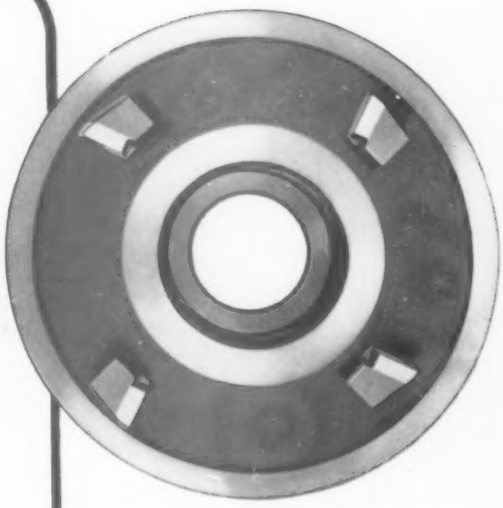
MANUFACTURERS OF POWER PRESSES TO 100 TONS • ROLLING MILLS • SWAGERS • TURRET HEADS

ANOTHER **NEW** LOVEJOY

CARBOLOY TIPPED
CEMENTED CARBIDE
TOOL-BIT-TYPE

"CUTSALL" STEP TOOTH MILL



Here's another new "Cutsall" to cut your milling costs. The staggered teeth give the results of four single fly cutters—with metal removing ability that will outstrip anything you've ever tried.

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"Cutsall" face and step tooth mills are available in 6", 8", 10" and 12" sizes—*all take a single blade size*—all will give performance unmatched by any other mills. Write for details and prices.

- POSITIVE and NEGATIVE RAKE, RIGHT and LEFT
- HAND in ONE HOUSING
- FINE BLADE ADJUSTMENT
- EXTRA LARGE CARBOLOY TIPS

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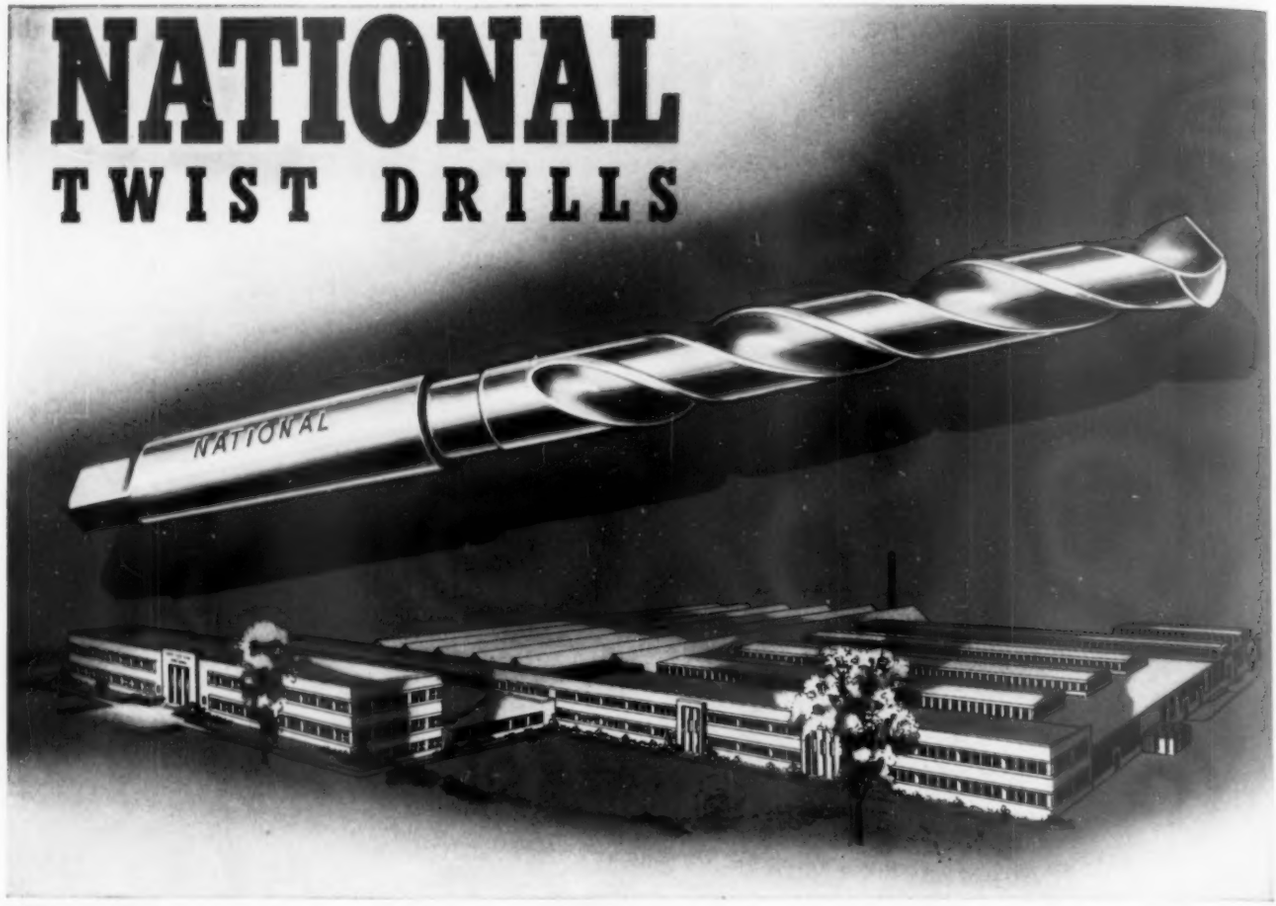
NATIONAL
TWIST DRILLS



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Select the *right* drill for the job at hand. NATIONAL offers deep hole drills, center drills, starting drills, and combined drills and countersinks—to name but a few—each specifically designed for a particular purpose. There are NATIONAL drills for working wood and plastics, as well as all kinds of metals and alloys.

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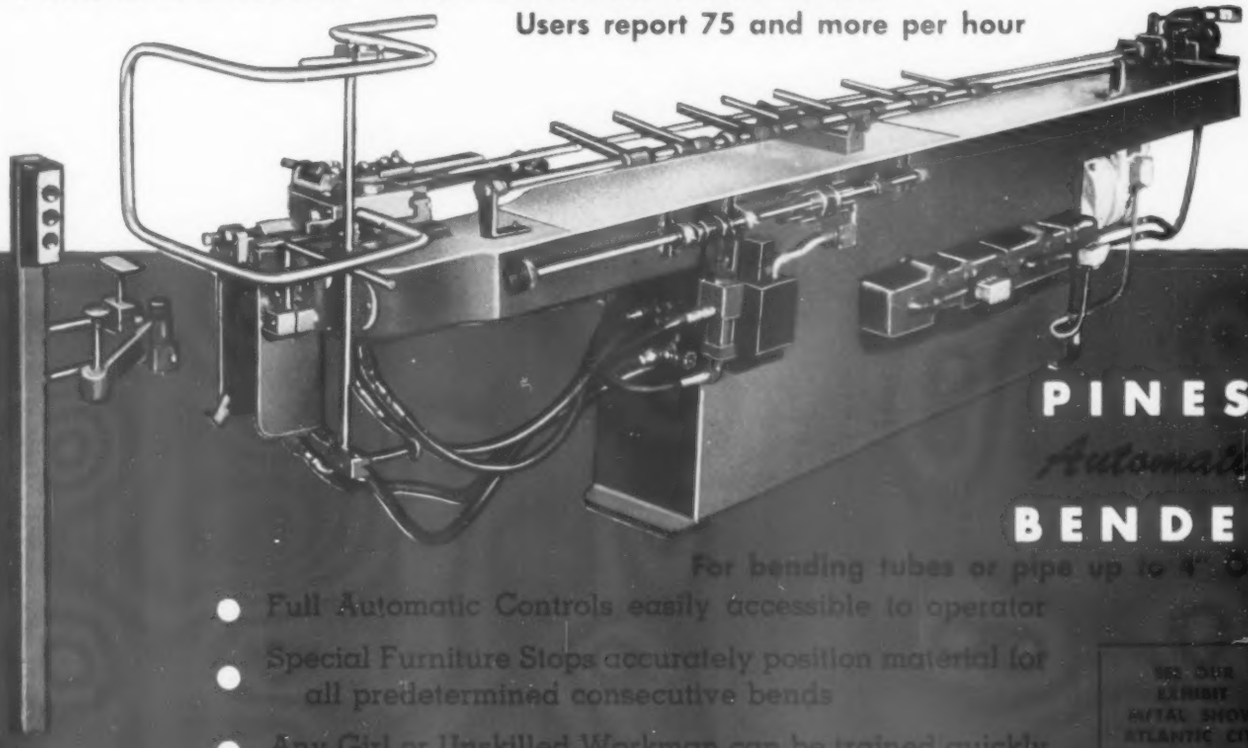
Users report 75 and more per hour



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- Any Girl or Unskilled Workman can be trained quickly to operate a PINES Bender at full production

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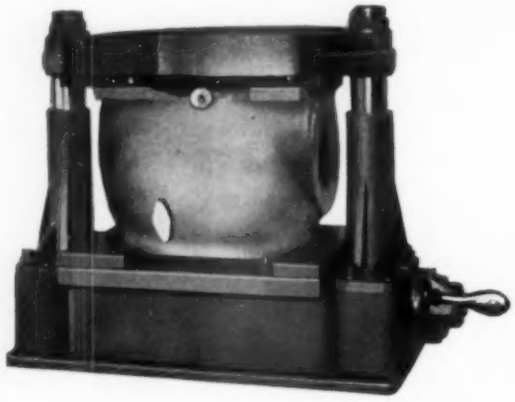

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Simple adapters added to a standard fixture starts your production faster.

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RESULT IN ECONOMICAL TOOLING AS FIXTURES CAN BE USED AGAIN ON SUBSEQUENT TOOLING PROGRAMS.

YOU SAVE IN DESIGN AND LOADING TIME

ASK FOR CATALOG 941

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Any Quantity Cut-off automatically

These MARVEL Saws are money makers for this modern forge shop in many ways. (1st) they cut-off billets for a small fraction of the cost of cutting-off with a hammer. (2nd) these billets are so accurate in size that they exactly fill the dies with no excess fin, not only simplifying trimming and finishing, but getting extra billets from many bars. (3rd) they keep all hammers busy on *production* work for these "world's fastest" saws can keep ahead of any schedule. (4th) they reduce cutting-off labor costs to an absolute minimum. It takes only one operator and a helper to keep all of these saws running because all but the No. 18 Giant Hydraulic Saw (at the right) are *automatic*—feed measure, and cut-off identical billets; requiring no more attention than automatic screw machines.

Your local MARVEL Sawing Engineer will gladly call and explain how you can add these five extra profits to your forge operation.

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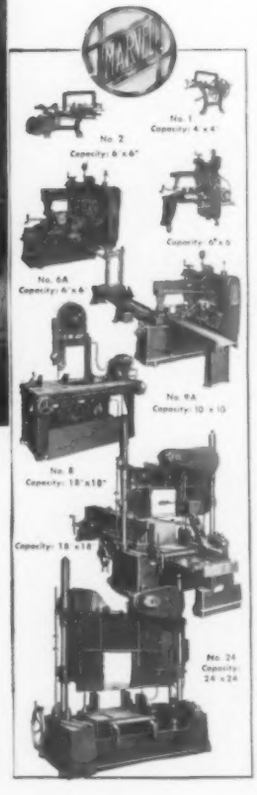
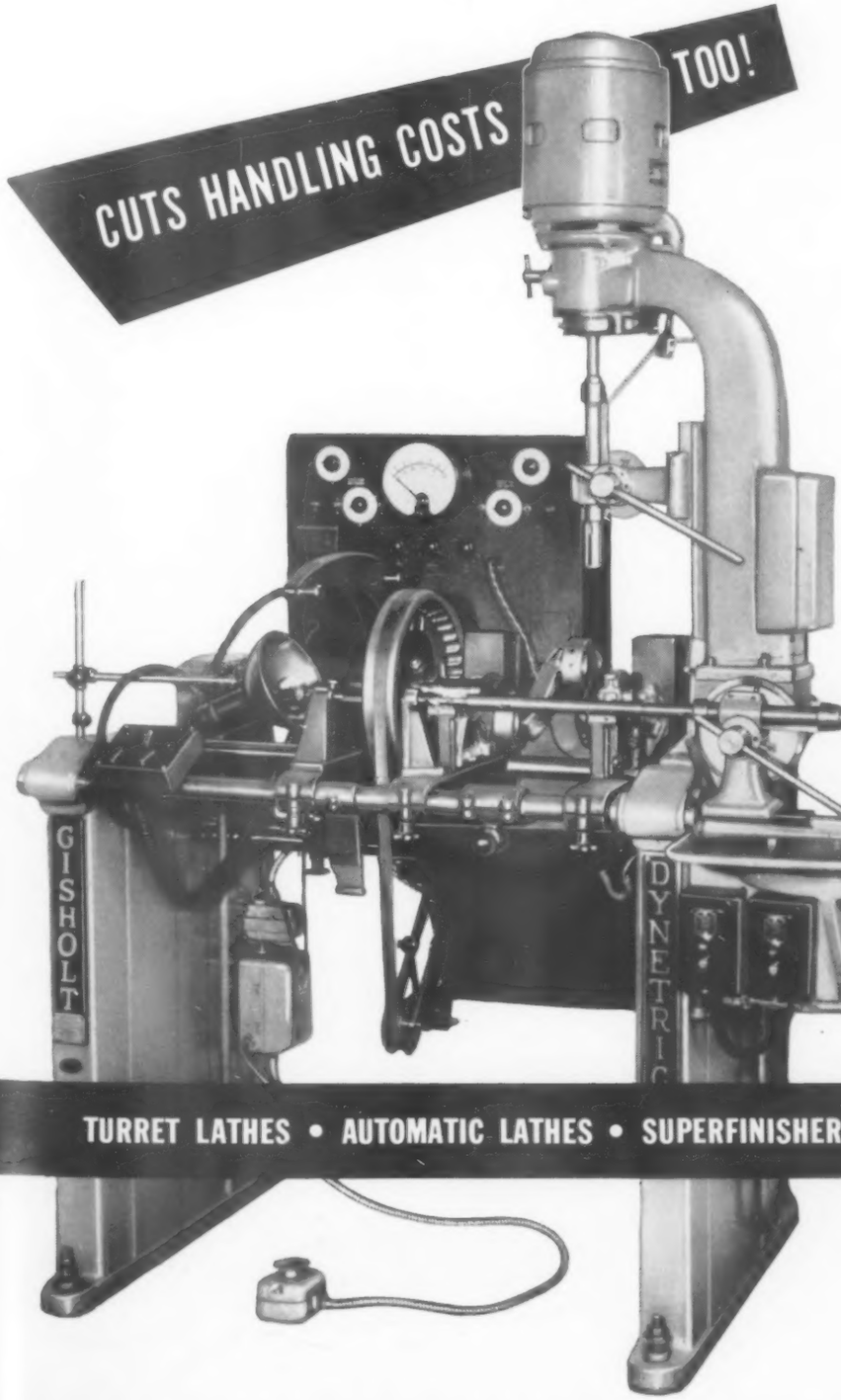


This New Trend in DYNETRIC* BALANCING

CUTS HANDLING COSTS TOO!



● Handling is a cost item to reckon with wherever you find it.

Here is one of the ways Gisholt is solving this problem in the Dynetric Balancing of many parts—as well as in the balancing of complete assemblies.

This Gisholt 3S Dynetric Machine is built complete with drilling equipment as an integral part of the machine, for making necessary corrections in both flywheel and crankshaft. The job illustrated, an assembly of two-throw crankshaft and flywheel, is heavy and awkward to handle. By making it possible to *measure* unbalance, to *correct* it, and to *check accuracy* with a single loading of these parts on the machine, two-thirds of the former handling time is saved. Two loadings and unloadings are eliminated. The saving in time and cost is obvious.

Here, perhaps, is an idea that can be applied to your balancing problems. Why not find out, and take advantage of the cost reductions as soon as possible? Write us for complete information.

**Developed jointly with the Westinghouse Electric Corp.*

GISHOLT MACHINE COMPANY

1257 E. Washington Ave., Madison 3, Wis.

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Look Ahead...
Keep Ahead...
with Gisholt

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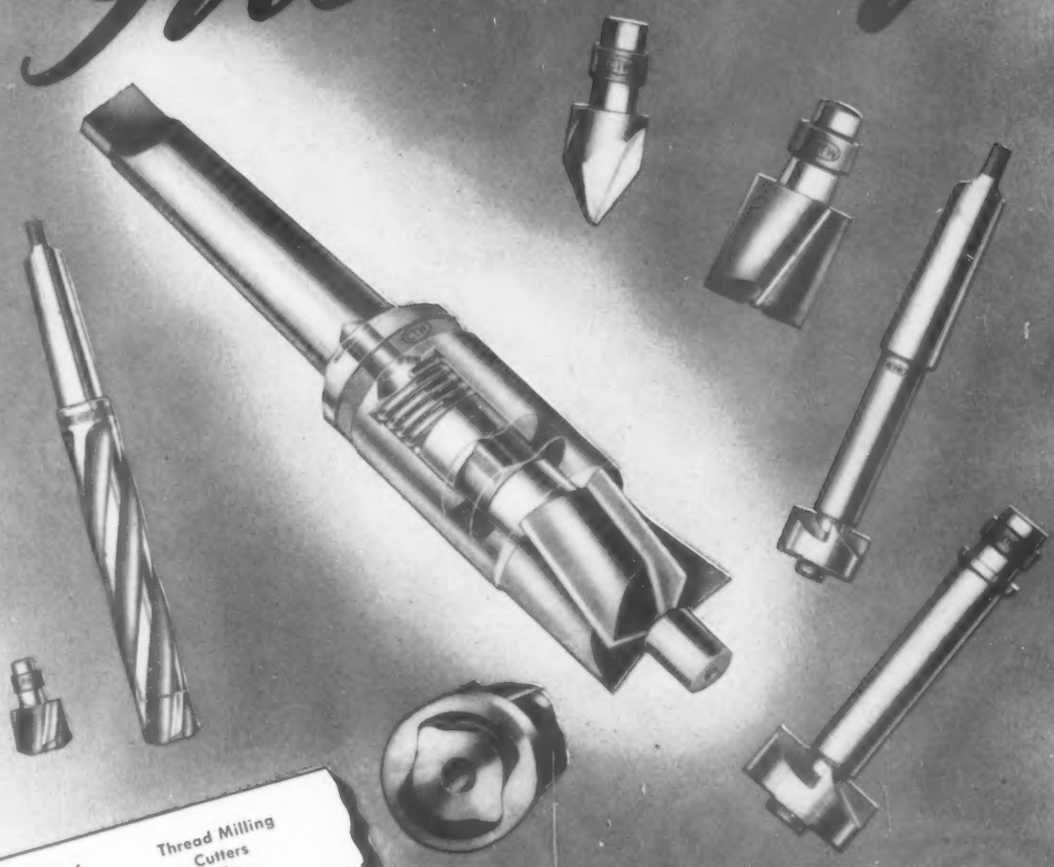
Instantly



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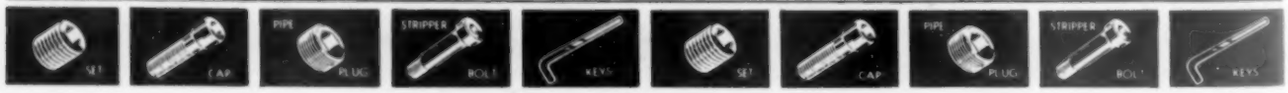
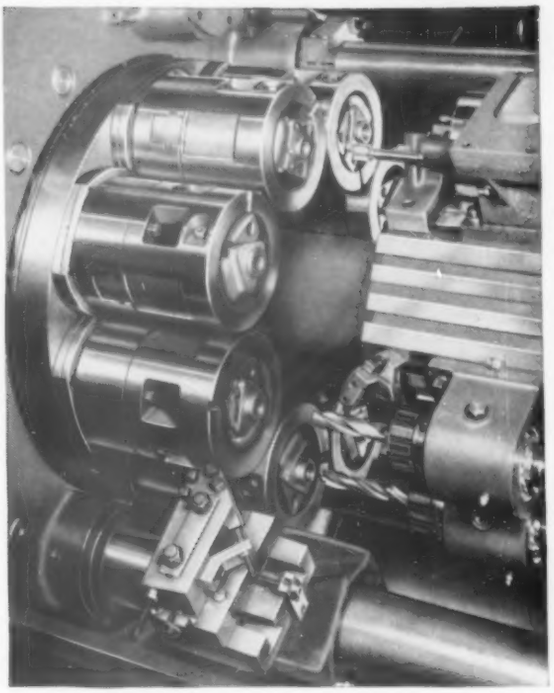




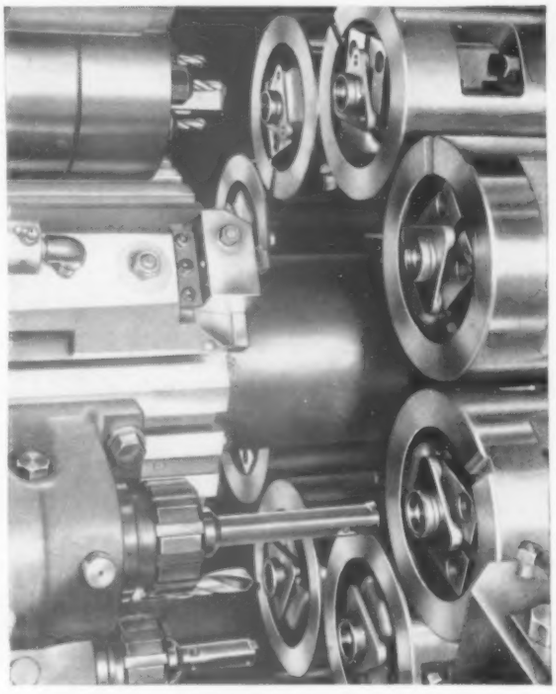
Entirely open end construction...
Loading position easily accessible

The master cylinder and supply tank illustrated above is manufactured by the Wagner Electric Corporation of St. Louis on a Model 88 New Britain eight spindle automatic work rotating chucking machine. The most difficult problem encountered in tooling this job was to synchronize the multiple drill head with the irregular shaped flange for accurate drilling of three mounting screw holes.

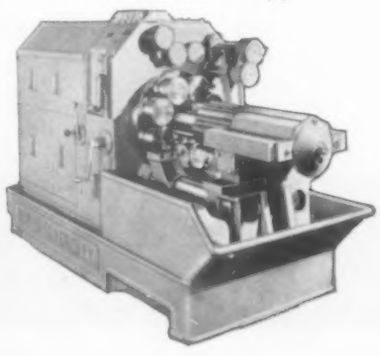
Our engineers developed a special hydraulically operated chucking fixture which positions the piece exactly the same at each chucking—permitting, with an ingenious locating device, proper synchronization of the drill head and the work. Otherwise the flange holes would have required a separate rehandling and a drill press operation with a resultant increase in the cost per piece.

Let our engineers help you to save extra operations in the machining of your work. Be sure to check with our field representatives or our home office about that new product you are designing or about better methods to machine your present products.

★



REAR VIEW: Note accessibility of all tools



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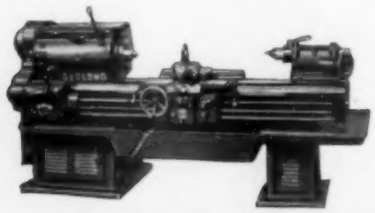
say LeBLOND AGENTS!

Here's something to remember . . .

LeBlond Agents know metal turning as few men know it. Since they offer the largest line of lathes available from one manufacturer, their unbiased advice on the selection of a lathe for any specific use . . . or any wide range of uses . . . can be relied upon.



THE R. K. MACHINE TOOL COMPANY

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